OCTOBER, 1942

ELECTRICAL SOUTH

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55th SEASON

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HUNTER, who has made fans and ventilators exclusively during 55 years, is now operating under War Production Board restrictions. • No more fans will be made except for the Army, Navy and Maritime Commission. • HUNTER unfilled orders now on hand total 98 percent direct contracts with Government Agencies.

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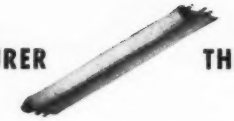
THE HAND CAN BE NO SURER  THAN THE EYE

Maybe it's easy for you to get Fluorescent!

MANY war plants that stand to gain immeasurably by fluorescent lighting do not now have it—mainly because priority regulations scare them off.

As a matter of fact Uncle Sam's policy is that any plant engaged in important war work may install fluorescent lighting — simply upon proving that there is a genuine need for better lighting.

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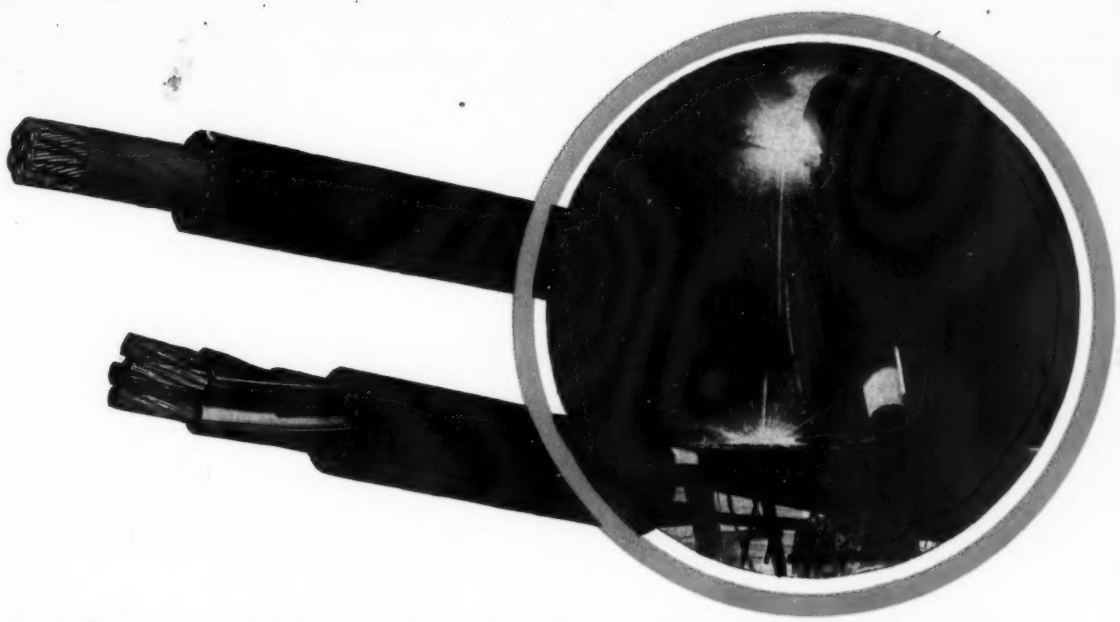

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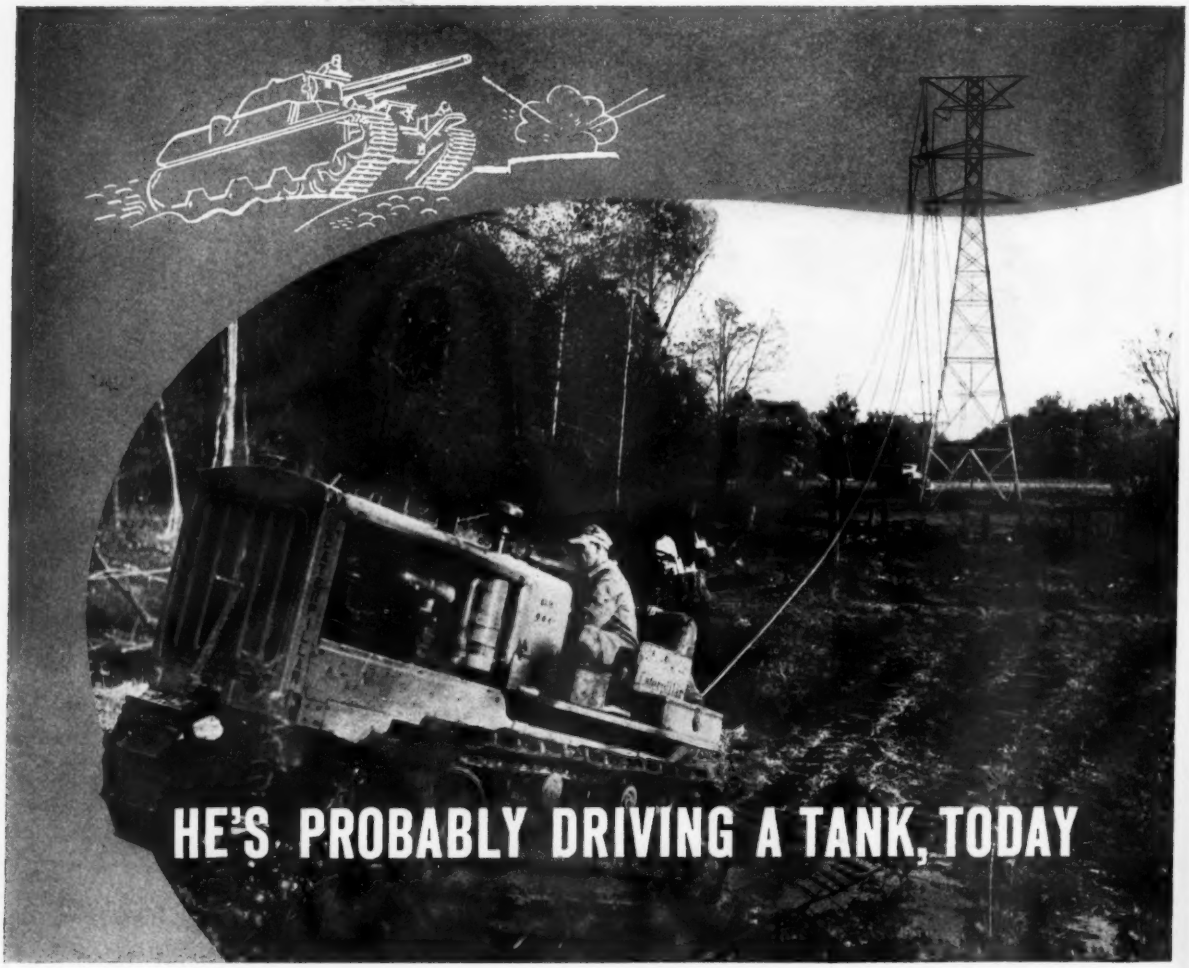
Subscription rates, United States and Possessions, $1.00 for one year; $2.00 for three years; Canada, $1.50 per year; Foreign Countries, $2.00 per year.
Entered as second class matter at the postoffice, Marietta, Ga., under Act of March 3, 1879.
Volume 22 Number 10



No land battleship could be maneuvered more cleverly than the way he handled this cable-stringing "cat." The skill with which he snaked the bull ropes through swamps, up hill and down, speeded erection of this important line. Today, this line is backing him up, carrying power to vital war-production plants.

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Both give you *automatic* protection

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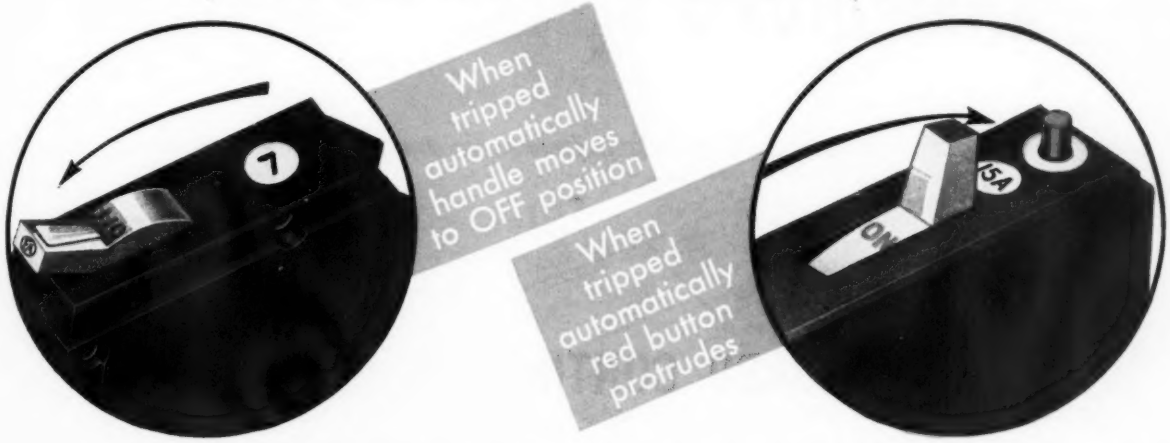
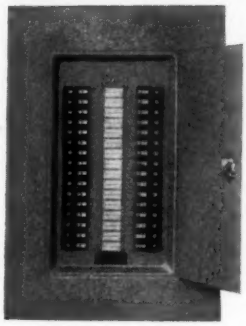


Type AC Circuit Breaker
PANELBOARDS

Dublbrak Circuit Breaker
PANELBOARDS



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Assembled from standardized units, with 4 to 42 branches.

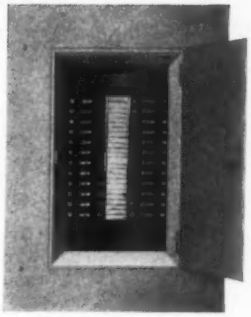
Capacities: 15 to 50 amps., 120 volts AC only, single pole.

At left: Ⓕ *Type AC Circuit Breaker Panelboard and Cabinet (Cat. No. NAC1B32-3L100), with 32 branch circuits.*

Assembled from standardized units, with 4 to 42 branches.

Capacities: 15 to 50 amps., 125 volts, single pole, or 250 volts, double pole, AC or DC.

At right: Ⓕ *Dublbrak Circuit Breaker Panelboard and Cabinet (Cat. No. NA1B24-3L100), with main lugs only.*



In both Types

of Ⓕ Circuit Breaker Panelboards, annoying interruptions of service from momentary overload are prevented by proper time lag characteristics. Protection against short circuit or harmful, sustained overload is assured — *the current is broken automatically before it can build up to a dangerous volume* . . . Installation is facilitated by new and improved terminal connectors — wide gutters — and ample knockouts in steel boxes . . . The fronts are bonderited to prevent rusting, then attractively finished in pearl gray lacquer.

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Bulletins 57 (Dublbrak) and 62 (AC) contain complete descriptions, dimensions and prices, with wiring diagrams and suggested specifications . . . Frank Adam Electric Company, St. Louis, Mo.

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One of its obvious values is that it encourages and assures the regular check-ups and thorough inspections so needed under today's conditions.

If a critical problem arises with no obvious solution, consult our engineering department or field service staff.

NOTE: The Preventive Maintenance Plan will aid your local W.P.B. Branch in making its decision on your request for material required to avert an actual breakdown.

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And for every potential weakness uncovered, a practical remedy is suggested.

The remedy, if applied in time, can be quite simple, whereas if actual breakdown is permitted to occur, correcting it may be costly and even impossible.

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"...for accomplishing more than seemed reasonable or possible"

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WAR DEPARTMENT
OFFICE OF THE UNDER SECRETARY
WASHINGTON, D.C.
August 22, 1942
Mr. E. G. Biechler, General Manager
Frigidaire Division
General Motors Corporation
Dayton, Ohio
Dear Mr. Biechler:
This is to inform you that the Army and Navy are conferring upon your organization the Army-Navy Production Award for high achievement in the production of war equipment.
The patriotism which you and your employees have shown by your remarkable production record is helping our country along the road to victory. The Army and Navy are proud of the achievement of the men and women of the Frigidaire Division.
In conferring this award, the Army and Navy will give you a flag to fly above your plant, and will present to every individual within your organization a lapel pin, symbol of leadership on the production front.
May I extend to the Frigidaire Division my congratulations for accomplishing more than seemed reasonable or possible a year ago.
Sincerely yours,
Robert P. Patterson
Under Secretary of War

☆ FRIGIDAIRE is proud to be numbered among the manufacturers receiving the distinguished Army-Navy production award. And in accepting this coveted pennant we accept also a challenge to even greater achievements until victory is won.

FRIGIDAIRE AT WAR

FRIGIDAIRE DIVISION ☆ GENERAL MOTORS CORPORATION ☆ DAYTON, OHIO

Peacetime Builders of Home Appliances, Commercial Refrigeration, Air Conditioners

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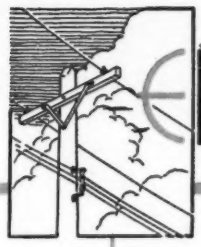
Volume 22 No. 10



ELECTRICAL SOUTH

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Published Monthly by
W. R. C. SMITH
PUBLISHING CO.
Marietta and Atlanta, Ga.

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T. W. MCALLISTER, *Vice-President and Editorial Director*,
E. W. O'BRIEN, *Vice-President*,
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Contents

Organized Maintenance for Industrial Plants	9
More Light on Blackouts	11
Laying Out Motor Circuit Wiring	15
Plastics are War Materials	18
Conservation Plan Keeps Equipment in Use	20
Three-Phase Winding Design for Old Motor Frames	22
Inventory Your Man Power Now	25
All-Out Appliance Service Plan	26
Maximum Price Regulations Affect Appliance Service	28
Service Sales Promotion Letters Prove Effective	30

Departments

Practical Helps for the Trade	31
News of the Electrical Industryy	38
Personal Notes About Men You Know	44
New Electrical Equipment and Materials	46

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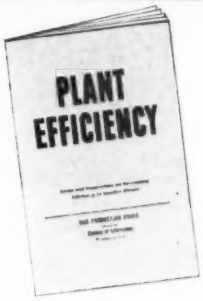
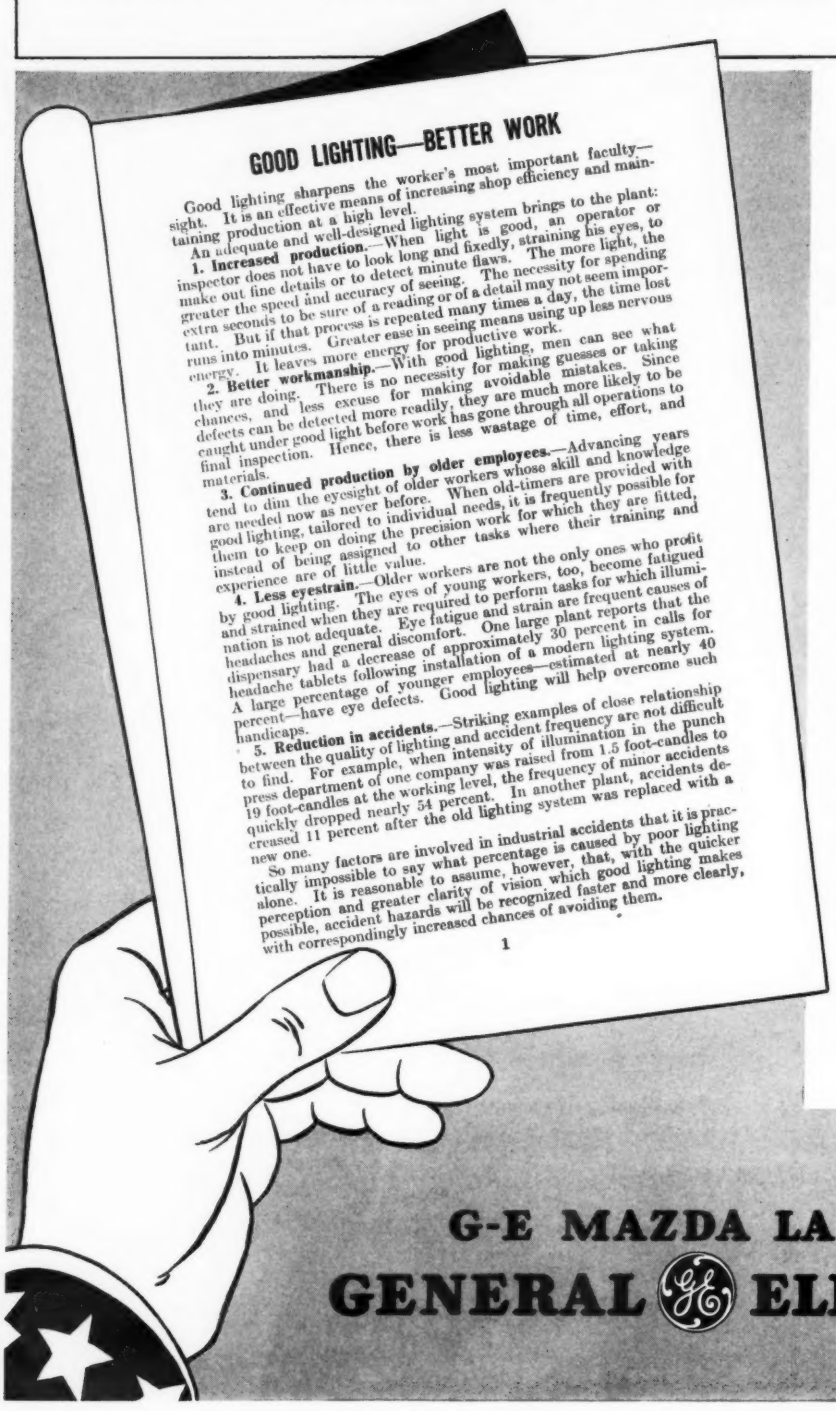
Entered as second class matter at Marietta, Ga., U. S. A., under Act of March 3, 1879.

HAVE YOU SEEN THIS NEW BOOK PUBLISHED BY THE WAR PRODUCTION BOARD?





GOOD LIGHTING—BETTER WORK

Good lighting sharpens the worker's most important faculty—sight. It is an effective means of increasing shop efficiency and maintaining production at a high level.

An adequate and well-designed lighting system brings to the plant:

1. Increased production.—When light is good, an operator or inspector does not have to look long and fixedly, straining his eyes, to make out fine details or to detect minute flaws. The more light, the greater the speed and accuracy of seeing. The necessity for spending extra seconds to be sure of a reading or of a detail may not seem important. But if that process is repeated many times a day, the time lost runs into minutes. Greater ease in seeing means using up less nervous energy. It leaves more energy for productive work.

2. Better workmanship.—With good lighting, men can see what they are doing. There is no necessity for making guesses or taking chances, and less excuse for making avoidable mistakes. Since defects can be detected more readily, they are much more likely to be caught under good light before work has gone through all operations to final inspection. Hence, there is less wastage of time, effort, and materials.

3. Continued production by older employees.—Advancing years tend to dim the eyesight of older workers whose skill and knowledge are needed now as never before. When old-timers are provided with good lighting, tailored to individual needs, it is frequently possible for them to keep on doing the precision work for which they are fitted, instead of being assigned to other tasks where their training and experience are of little value.

4. Less eyestrain.—Older workers are not the only ones who profit by good lighting. The eyes of young workers, too, become fatigued and strained when they are required to perform tasks for which illumination is not adequate. Eye fatigue and strain are frequent causes of headaches and general discomfort. One large plant reports that the dispensary had a decrease of approximately 30 percent in calls for headache tablets following installation of a modern lighting system. A large percentage of younger employees—estimated at nearly 40 percent—have eye defects. Good lighting will help overcome such handicaps.

5. Reduction in accidents.—Striking examples of close relationship between the quality of lighting and accident frequency are not difficult to find. For example, when intensity of illumination in the punch press department of one company was raised from 1.5 foot-candles to 19 foot-candles at the working level, the frequency of minor accidents quickly dropped nearly 54 percent. In another plant, accidents decreased 11 percent after the old lighting system was replaced with a new one.

So many factors are involved in industrial accidents that it is practically impossible to say what percentage is caused by poor lighting alone. It is reasonable to assume, however, that, with the quicker perception and greater clarity of vision which good lighting makes possible, accident hazards will be recognized faster and more clearly, with correspondingly increased chances of avoiding them.

1

EVERY war plant in your territory should have a copy of this new 39-page booklet on Plant Efficiency, published by the War Production Board. The WPB is anxious to give it as wide distribution as possible—and you can help!

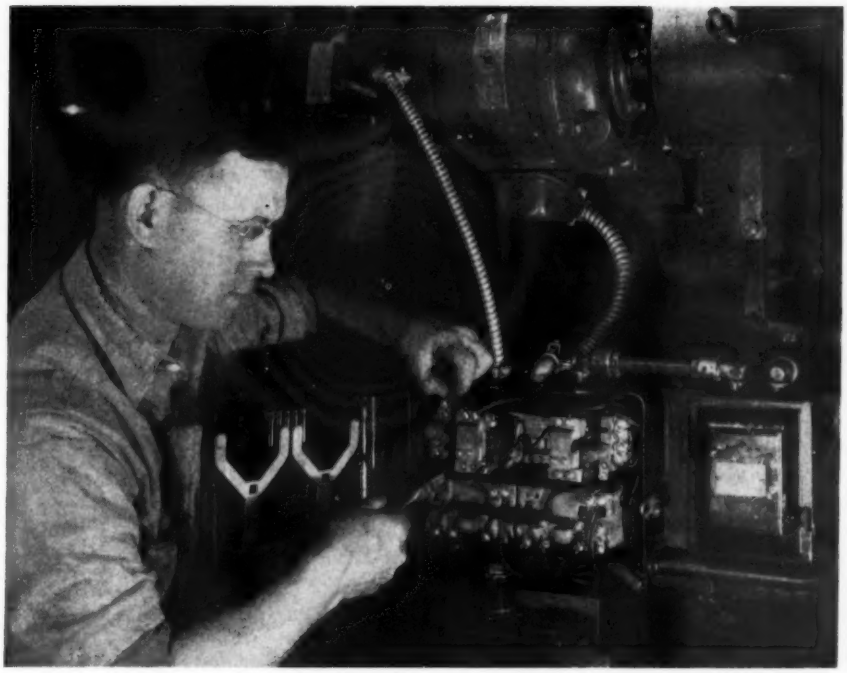
It covers such important production problems as, adapting old machines to new jobs, maintenance and repair, worker training, plant protection, getting into war work, etc. And naturally lighting is given an important place as it is vitally important to precision work.

We suggest you contact your local WPB office without delay to get copies for your industrial customers. If they've run out, write War Production Board, Washington, D.C.

The General Electric Company, through our staff of lighting engineers, is glad to cooperate with you to help your customers speed war production with better lighting. General Electric Company, Nela Park, Cleveland, O.

G-E MAZDA LAMPS

GENERAL ELECTRIC



Regular inspection of motor linestarters reduce time outages. This unit starts a motor used in operating a multiple die punch press. (All photos courtesy of Westinghouse Electric & Mfg. Co.)

Organized Maintenance

With our Victory effort depending upon uninterrupted industrial production, more attention must be given to preventive maintenance of electrical equipment.

THE MAINTENANCE department in any industry today has a vital responsibility in the war effort to keep hard-pressed equipment in operation. The 168-hour week now in force in many war production plants has increased the maintenance problem many times. And those who are responsible for maintenance must think fast and keep prepared for any eventuality that might occur. They must be able to take care of any such condition in the shortest possible time with the least interference of production schedules.

Best results in any large plant will be obtained through the use of organized maintenance schedules. Such maintenance must include not only the machine tools and productive equipment but must also consider the electric power supply, electrical circuits, steam and compressed air sources, etc. Obviously, it would do little good to have machine tools in A-1 condition only to have them shut down later due to a circuit breaker failure in the electrical system, or some other such failure.

The problem of maintaining equipment in large industrial plants will vary according to the type of plant. For example, an industrial plant containing a large number of individual production units will present maintenance problems entirely different from those of a large automobile plant, where the entire output of that plant is geared to conveyor assembly lines. In either case, operating efficiency depends entirely upon a thorough inspection setup, since the finding and correcting of minor troubles prevent the occurence of major ones. This is called preventative maintenance.

In a large plant comprising a number of divisions, it may be found advisable to organize a separate division for general factory service. Such a division would maintain buildings, distribution lines such as water, gas, steam, air and electric power, and would be responsible for repairs of larger equipment such as cranes, hoists, elevators, and for major rearrangements of departments and equipment.

In one large industrial plant, however, it has been found advisable to have each division maintain its own machine tools and manufacturing equipment, except where the repair is too large in which case they call upon the factory service division to make the repair.

In each separate division, a tool supervisor is responsible to the superintendent of the division for keeping all equipment fit to meet the production schedules. This plan has worked but very satisfactorily because each supervisor has

his own maintenance department with several inspectors who are continually inspecting machines. All machine tools, electrical equipment, etc., are checked monthly for any defects that may have occurred, and observations are made on an inspection report indicating the defect and the work required.

In smaller industrial plants, of course, it is not necessary to have such a large maintenance organization. Perhaps the extent of the equipment is such that a single chief maintenance engineer and one or two helpers can keep it in proper operating condition. Regardless of the size of the plant, and the number of men employed on maintenance work, it is most desirable that the maintenance be handled in accordance with a definite plan or schedule.

Such a schedule should be prepared so that the available time of the maintenance crew is used to best advantage. It is advisable to prepare a large chart for a twelve months' period so as to show every item of equipment that must be inspected and the intervals at which it is examined. The chart should be designed so that a space is provided to indicate the date upon which inspections have been completed.

In preparing such a maintenance schedule, particular consideration should be given to manufacturers' instructions. For example, the recommended interval for lubrication of electric motors will vary considerably for differ-

(Continued on page 56)

(Top) Oiling the motor regularly is essential to long bearing and shaft life. The oil level shown in the cup held in the left hand of this operator indicates the proper amount. Too much oil may contaminate the motor windings, causing possible deterioration of the insulation.

(Center) A thorough motor maintenance program does not neglect brushes. Proper method of cleaning and surfacing is to press the brush down on a strip of sand paper placed between the brush and the commutator. The sand paper is then pulled in the direction of commutator rotation. Several passes should be sufficient, depending on the brush condition.

(Bottom) It is essential to keep a motor clean by using a suction hose or by blowing with an air line. Although a metal cover (removed) gives some protection to this motor installed on a carpenters saw, sawdust will get to the windings.

More Light on Blackouts

By Lawrence C. Porter* and Janet E. Davenport*

"BLACKOUT" and "lighting" are indeed strange partners. One is the antithesis of the other; yet in this topsy-turvy world of today they go hand in hand. Blackouts are our protection from an enemy soaring high above us and dropping his cargo of destruction. Lighting is our protection against accidents and sabotage on the ground. Without some light we would be in greater danger from bumping into or getting caught in machinery, stumbling over furniture, falling down stairs, or walking into moving vehicles than we would be from dropped bombs.

Blackout lighting should be of a minimum amount and of a quality which will not penetrate the darkness for any distance. Certain standards of lighting have been set and specifications issued by the War Department to cover many necessary activities which must be carried on in our industrial plants, offices, streets, hospitals and homes during the time when the lights must be turned off or concealed.

When we consider the fact that the flare of a match struck in total darkness is distinctly visible to aerial observers thousands of feet above the ground, we realize that the level of illumination on the ground must be at a minimum. Almost all human activity depends directly or indirectly upon light, whether natural or artificial. The problem in blackouts is to keep as much light as practical available for use while concealing it from observation by the enemy.

In order to arrive at the minimum intensity which would be safe for the different types of activities a great deal of basic research work was necessary. The laboratory facilities of the General Electric Company have been made available to the Army Engineer Board, and for more than a year cooperative research, under the direction of Major Warren S. Everett, has resulted in findings of benefit to the Army, the Navy, and civilians.

Measurements made in the laboratory have determined the threshold of visibility — the minimum amount of light which the human eye can discern, which is approximately 1/1,000,000 of the light emitted by an ordinary tallow candle. It was then necessary to determine the number of times laboratory threshold which would be safe to use for blackout under various atmospheric conditions, distance of observation, brightness and color of various backgrounds, etc.

A special instrument was developed recently which measures extremely low brightnesses —as low as .000005 footlamberts, which is pretty dim! Another instrument was developed which determines the number of times laboratory threshold values the conditions of visibility are in any one test. Thus, results from a test in one location and under certain

A blackout bulb kept handy to the kitchen range can be quickly substituted for regular lamp. In many instances, double socket arrangements can be used so that the change can be effected in a few seconds.

*Both of General Electric Company's Lighting Engineering Department, Cleveland, Ohio.

seeing conditions may be compared with results from other tests at different times, locations, and conditions of visibility.

Many aerial observation tests have been conducted to determine these things. A great deal of equipment is involved in such tests. There must be radio communication between the observation plane, or dirigible—as the case may be, and the ground sources. There must be telephone communication between the sources along the test course, and the test area must be completely blacked out, which involves the cooperation of the residents in the area. In addition to this, there is the necessity of making such tests in the dark of the moon, which is of relatively short duration, and dependence upon weather conditions.

Specifications for indoor blackout lamps and instructions for their use have been issued by the War Department. At present they are available only on A-2, or higher, priority order. Approved lamps must have the War Dept. marking indicated in inset.

Color Effect Analyzed

Contrary to general belief, blue light is not ideal for blackout. Many tests have proved that blue light can be picked up more readily at greater distances than red. For example, if the reader were to consider himself the apex of a triangle, the other two points being a red light and a blue light respectively, he would find the red light visible only when looking directly at it and in a relatively narrow angle, while the blue light would be visible through a much greater angle—and therefore more easily located—since the side of the eye is very much more sensitive to blue. It was also found that the eye focuses more sharply and becomes "dark adapted" more quickly under red light; and at very low brightnesses it is easier to read fine print or the dials of instruments under red light.

Once this fact was definitely established, research work was continued on the premise that red, with variations in density and shade through orange to white, was the ideal color for blackout. The War Department issued an order prohibiting the use of blue for blackout lighting in all Army theatres of operation and corps areas.

Red, however, could very easily cause confusion in public buildings since red has always been used as a danger signal and for exit markers. It is usually an indication that something is being protected.

There was also the problem of color distortion. There is no question that red does distort other colors. Many tasks in the home must be carried on during blackouts, and if deep red were used in the kitchen milady might fry some pork chops when she thought she was frying liver. Or she might cook some green peas, thinking they were diced beets. A deep red also is psychologically irritating, especially to women. Red was tested in homes as well as in the laboratory, and the opinions of home makers as well as home lighting specialists sought. The protests were vigorous and unmistakable.

So, for indoor blackouts, a compromise was made on orange. This color is pleasant to work under. It gives a reasonably normal color rendition, and it filters out the blue light which is always present in white.

After the color of light was decided upon the problems of application were taken up. A manufacturing plant working on war production cannot be expected to turn out all lights and cease working on war production upon receiving an alert. The answer should be complete obscuration of all windows, doors, skylights, and other sources of light visible from the exterior. Such obscuration could be secured by opaquing windows, skylights, etc., with paint or with shutters. Thus production could continue until an air raid is imminent, at which time the main power switch could be pulled, plunging the factory into complete darkness except for dimly lighted passageways to safety zones or air-raid shelters.

The lighting for such passageways should be on separate circuits fed from auxiliary sources of power, such as storage batteries or small gasoline electric sets. A separate system of blackout lighting over the entire working area of the plant is not to be desired as such an installation would require many critical materials as well as the cost of labor and time necessary to make the installation. Moreover, the illumination provided by such a separate system would not be sufficient to permit continuance of work during the blackout period.

The premise on which the streetlighting specifications were prepared by the War Department was that normal lighting will prevail except when and where blackouts are ordered. The most effective blackout, of course, would be the complete elimination of all artificial light. However, such a total blackout would seriously handicap the activities of essential personnel engaged in air-raid duties at a time when their services are of vital importance. Air-raid wardens, doctors, nurses, firemen, police, military personnel—all are of vital importance, and it is essential that they be able to move about and perform their services. Therefore, the purpose of blackout street lighting is to provide the greatest possible illumination for necessary activities with the minimum possible danger of detection.

White Best for Streetlighting

White light has been found to be the most suitable for blackout streetlighting since blue light is most easily detected from the air, and red is easily confused with traffic signals, automobile taillights, etc., and gives a limited view of obstacles at the sides of the road. The streetlighting specifications call for the use of average levels of illumination of .0003 footcandle at street level and of not more than .0006 footcandle anywhere — which amount of illumination is approximately double that provided by starlight on a clear moonless night.

To obtain this blackout streetlighting, luminaires can emit not more than approximately 1½ candlepower in any direction below the horizontal and practically no light above the horizontal.

Two methods have been devised to obtain the satisfactory operation of blackout streetlighting units. One method is to connect the low wattage luminaires in multiple to an auxiliary circuit of special streetlighting units and burn them continuously. When a raid is imminent the regular streetlighting units may be turned off and the blackout lighting will be available whenever needed. For use in such luminaires 9-watt inside-frosted incandescent lamps which are specially designed to have long life are specified.

The other method is to provide switching facilities and assign responsible personnel to turn the streetlighting units on quickly—in not more than two minutes after the official blackout signal is given.

Street traffic signals are another problem which has been solved. Here, again, two systems have been used. One, the approved method, is to reduce the voltage when an alarm is given to the point where the light is invisible from bombing altitudes. An alternative method which does not meet with approval by the War Department, is to equip the traffic signals with discs having small slots in them, the signal burned at full voltage at all times. The latter method is unsatisfactory in that in daytime the signal may be almost invisible—or at least barely visible—while the former method allows the units to be returned to full daytime effectiveness after the raid.

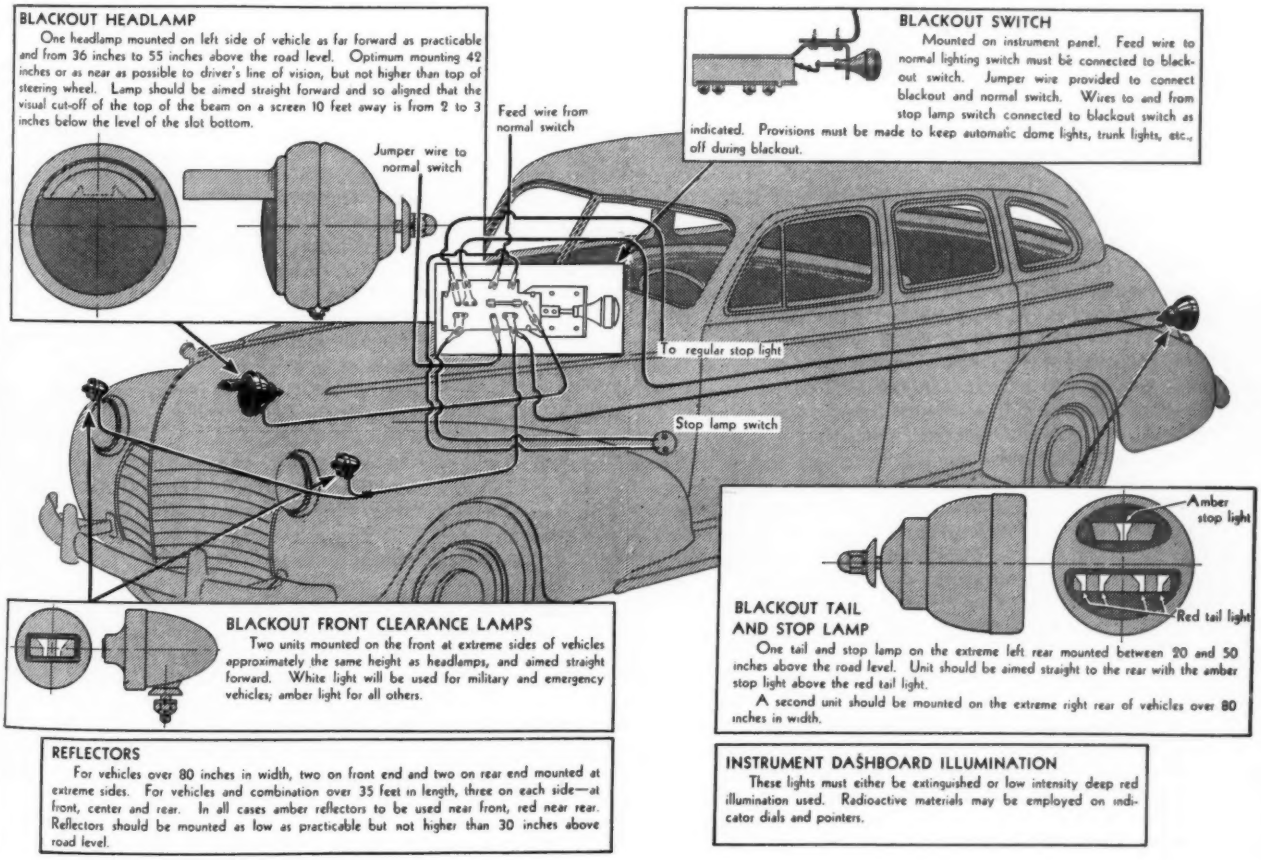
Vehicle Blackout Equipment

In addition to streetlighting and traffic signals, it was necessary to design and develop blackout equipment for motor vehicles. Because of the low level of illumination required to prevent detection by bombers it is inadvisable for the driver of any conveyance to attempt to operate it during a blackout until his eyes have become properly dark adapted. At least five minutes in complete darkness normally accomplishes this result.

The War Department specification requires all military vehicles used in blackouts to be equipped with one headlamp mounted to the left of the center, preferably as near as possible to the driver's normal line of vision, and sufficiently forward to prevent reflection from any portion of the vehicle. The unit has a mask with only a small slot for emission of the light, a lens to give proper distribution of light, a beam of not over 50 candlepower, and a visor to prevent the light from going upward. The approved mounting height for the unit is approximately 42 inches. A headlamp of this type must be so aimed that the beam is projected straight forward and visual cutoff on top of beam on a vertical screen 10 feet in front of lens is at least two inches and not more than three inches below bottom of slot. Properly aimed, the headlamp lights the road from approximately 20 to 150 feet ahead of the vehicle.

Since the driver of an approaching vehicle could not easily see such a headlamp, two marker lamps have been specified. White marker lamps will be used for

Below, specifications for motor vehicle blackout lighting.


BLACKOUT HEADLAMP
One headlamp mounted on left side of vehicle as far forward as practicable and from 36 inches to 55 inches above the road level. Optimum mounting 42 inches or as near as possible to driver's line of vision, but not higher than top of steering wheel. Lamp should be aimed straight forward and so aligned that the visual cut-off of the top of the beam on a screen 10 feet away is from 2 to 3 inches below the level of the slot bottom.
Jumper wire to normal switch
Feed wire from normal switch
BLACKOUT SWITCH
Mounted on instrument panel. Feed wire to normal lighting switch must be connected to blackout switch. Jumper wire provided to connect blackout and normal switch. Wires to and from stop lamp switch connected to blackout switch as indicated. Provisions must be made to keep automatic dome lights, trunk lights, etc., off during blackout.
To regular stop light
Stop lamp switch
Amber stop light
Red tail light
BLACKOUT TAIL AND STOP LAMP
One tail and stop lamp on the extreme left rear mounted between 20 and 50 inches above the road level. Unit should be aimed straight to the rear with the amber stop light above the red tail light.
A second unit should be mounted on the extreme right rear of vehicles over 80 inches in width.
BLACKOUT FRONT CLEARANCE LAMPS
Two units mounted on the front at extreme sides of vehicles approximately the same height as headlamps, and aimed straight forward. White light will be used for military and emergency vehicles; amber light for all others.
REFLECTORS
For vehicles over 80 inches in width, two on front end and two on rear end mounted at extreme sides. For vehicles and combination over 35 feet in length, three on each side—at front, center and rear. In all cases amber reflectors to be used near front, red near rear. Reflectors should be mounted as low as practicable but not higher than 30 inches above road level.
INSTRUMENT DASHBOARD ILLUMINATION
These lights must either be extinguished or low intensity deep red illumination used. Radioactive materials may be employed on indicator dials and pointers.

military and emergency vehicles, and amber marker lamps for all other. These marker lamps are of such candlepower that they will not be visible beyond 1,000 fet.

An ingenious combination tail and stop light has been developed which allows the operator to judge the approximate distance of the car in front. This light has four small red openings in the mask so shaped and spaced that at distances of less than 60 feet all four openings are visible. From 60 to 80 feet each pair of openings merges so that only two lights are seen, and beyond 180 feet all four merge and appear as a single red light. In addition to this, there is an amber stop light which is visible up to 1,000 feet.

Deep red light is used for all instrument and panel lights during blackouts, since the eye focuses most sharply under this color.

All of this equipment is connected to a separate switch which automatically cuts off the regular lighting when the blackout equipment is turned on.

Tests carried on in various locations throughout the country are leading to a solution of the problem of railroad blackouts. The Army Engineer Board with the cooperation of the Association of American Railroads has made many aerial as well as ground observations, and the results obtained will be incorporated in a War Department blackout specification.

Blackout Flashlights Developed

Flashlights, too, came in for their share of scrutiny. While the War Department has not as yet issued specifications for flashlights, the ones in preparation call for an orange light of such low brightness that even if that light is pointed directly at a bomber flying at probable operational heights it cannot be seen. Nevertheless, flashlights should never be pointed above the horizontal during a blackout If the flashlight is equipped with an automatic switch to turn off the light when pointed above the horizontal, a little greater lumen output may be used, as the reflected light from a piece of white paper is not of so high intensity and therefore not so readily detectable as if the light source itself were pointed directly at the bomber. In this case the light emitted above the horizontal at the angle at which the switch turns it off is closely limited.

Until official specifications are issued for flashlights perhaps the best and easiest thing that can be done to an ordinary two-cell flashlight to make it suitable for blackout service is to place three thicknesses of paper, of the density used in the Saturday Evening Post or its equivalent, with printing on both sides, under the cover glass and make sure the flashlight is never pointed upward.

For the purpose of blacking out buildings with retention of illumination sufficient for movement a special indoor blackout lamp has been designed. This lamp is a 14-watt tungsten filament lamp with the bulb completely opaqued by a black ceramic coating, or some material which cannot be scratched off easily, with the exception of an orange colored aperture one inch in diameter on the end of the bulb. (See page 12.) The lamp may emit not less than 1½ lumens and not more than 3, with not more than .15 lumen emitted above the horizontal.

Specifications for the indoor blackout lamps and instructions for their use have been issued by the War Department. However, the general sale of the lamps has not been released by the War Production Board and at present they may be secured only on better than an A-2 priority order.

A nationally known testing laboratory has been designated by the War Department to test all blackout lamps and equipments. This testing laboratory submits reports on the lamps or devices coming within the specifications to the Engineer Board; the Engineer Board then notifies the manufacturer that he may place such equipment on the market, with the following marking "Blackout (insert item of equipment) — War Dept. Standard," followed by a code number. General Electric indoor door lamps are marked as shown.

The rules set for the use of indoor blackout units are specific. For example, the end of the bulb must not be pointed toward an outside door or window. If no shades or other coverings are used on the windows, the lamps must be mounted above the tops of the windows. In small or medium sized rooms (200 square feet of floor area or less) only one lamp per room may be used.

In larger rooms, and in corridors, one lamp may be used for each 100 square feet of floor area, although the lamps may not be located less than 10 feet apart in any direction and not less than 15 feet apart in a corridor. Also, the lamps must not be closer than three feet to a window.

Advantages of Indoor Lamp

The indoor blackout lamp can be used to advantage instead of many gadgets which are on the market for blackout service. One advantage is that only the bulb itself is needed without auxiliary equipment, such as paper shields which might be a fire hazard or metal ones that use critical material. A large variety of types and sizes of gadgets would be necessary to fit the numerous types of lighting fixtures now in use, thus wasting much essential material. Another advantage of the indoor blackout bulbs is that they would be easily recognized by air-raid wardens as approved, and therefore safe, blackout units.

Several special types of lighting units have been developed, such, for example, as a portable battery operated sign and a portable light which may be attached to essential fixed signs. The portable sign device can be used to indicate the location of casualty stations in various air-raid sectors, or by a field army to indicate the location of a particular unit which may be changing its position frequently.

Luminescent materials — particularly phosphorescent materials— are becoming increasingly important for a large number of indoor applications. However, because these materials deteriorate rapidly under exposure of sunlight and moisture, they are not generally to be recommended for continuous outdoor use. Useful indoor applications of luminescent materials include marking of individuals by means of belts, arm bands, or other insignia and delineation of corridors, hand rails, stairs, doors, door knobs, switches, etc.

Many other devices for this important business of blackout are in the process of development, some of which are in the "restricted" class and cannot be divulged since they are for use primarily in military operations. The War Department, the Navy Department, the General Electric Company, and many other industrial laboratories are working unceasingly to supply the greatest protection possible for our armed forces and for civilians.

Laying Out Motor Circuits

In this continuation of his discussions on industrial wiring, Ben Z. Segall analyzes the minimum motor circuit requirements given in National Electrical Code.

THE DESIGN of motor circuits seems to involve more mystery and misunderstanding than almost any other part of an electrical system. Plans, which to all intent and purposes, are well drawn and excellently thought out, when expedited in the actual plant, do not accomplish the objective set up by the operators. The minimum code standards must be applied with full knowledge of their limitations. Nothing can serve as a substitute for an intelligent application of these values to the actual design in hand.

Primarily all design should be made with certain cardinal points always in mind. Develop a wiring system which will give an overall efficiency commensurate with the economic aspects involved. In line with this, it is well to keep in mind the discussion of the various wiring systems given in the previous articles. Any design which does not compensate in some measure for voltage drop and low power factor will not result in satisfactory operation of the motor loads.

Incidentally, it should be remembered that voltage variations do not affect motors as greatly as it does other types of loads. In general ten per cent variation above, or below, normal voltage rating will give good motor operation. However, every effort should be made to keep motors operating at as near normal voltage as possible. The wiring system therefore may be designed with a greater leeway in voltage regulation. Each particular plant will have to be analysed to determine the best overall picture.

The use of higher voltage motors will prove of particular advantage. Thus 440 volt motors on welder motor generator sets will fit into a much better and more economical wiring system. Large plants should certainly be designed to take advantage of the various types of load center distribution systems. The electrical equipment manufacturers have developed excellent material available for guidance in the design of these layouts.

Five factors are involved in the design of motor circuits:

1. Size of the motor circuit conductors.
2. Size of the running protective device.
3. Size of the starting protective device.
4. Size of the motor controller.
5. Size of the motor circuit disconnect.

Figure 24 shows these components for a single motor installation and Figure 25 for a more complex layout. The diagrams do not attempt to point out all of the requirements for the design of the various components. These will be brought out in more detail in subsequent discussions.

The size of the motor circuit conductors must be determined for each individual motor, subfeeder and feeder. It includes, of course, all wiring between the motor terminals and the source of supply.

The running overcurrent device is employed to protect the following against motor overloads: (a) the motor, (b) the motor control apparatus, and (c) the branch circuit conductors between the controller and the motor. Overloads cause excessive heating and subsequent deterioration of insulation and equipment. This device is usually incorporated in the motor controller unit as a thermal unit.

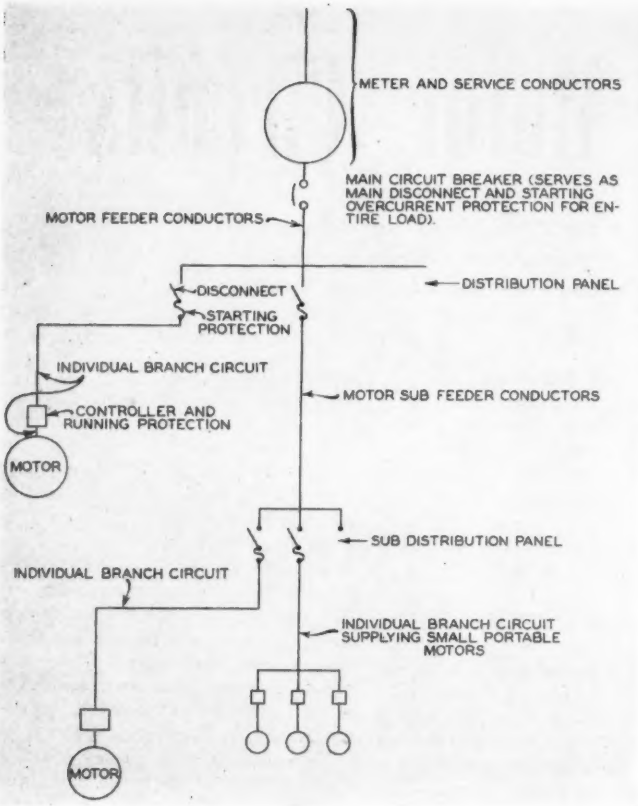
The starting overcurrent protects (a) the motor, (b) the motor control apparatus, and (c) the entire branch circuit or feeder circuit, from the source to the motor, against grounds or short circuits. This protection is usually incorporated with the disconnect unit as fuses or circuit breakers.

The motor controller is used to directly start or stop the motor. It may be arranged, also, to control the motor speed.

The motor disconnect provides a means of completely cutting off the motor, its protective equipment, and control apparatus from the source of supply. This provides for safe maintenance of the motor and its associated equipment.

The disconnect under certain conditions may serve as both controller and disconnecting means. Equipment is available wherein all overcurrent protection, disconnecting, and control units are housed as one casing.

The minimum size of the conductors for an individual motor is determined from the full load running current of the motor. Tables 21, 22, 23 and 24, of the National Electrical Code, 1940 Edition, show these values for the various types and sizes of d-c and a-c motors. The question is often raised as to just what value to use, that shown in the table or the name plate full load current rating? An official Code Interpretation (No. 197), recently issued, definitely states that the table values should be taken as the full load current in lieu of the name plate rating. However, this ruling states that for certain conditions these values must be modified as provided in the table footnotes. These modifications will be indicated in the following paragraph. To give further cognizance and official status to this ruling a Code revision has been proposed (new section 4309) stating "Whenever the current rating of a motor is used to determine the current carrying capacity of conductors, switches, branch cir-



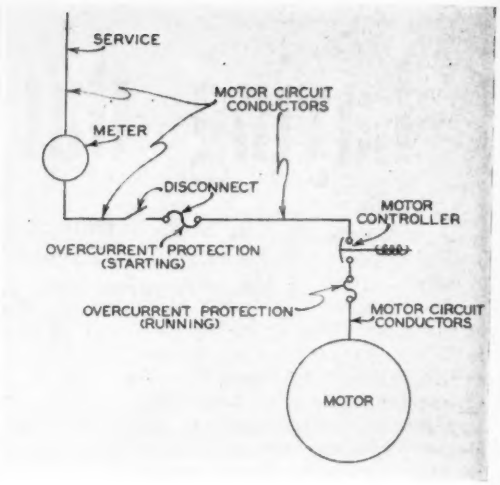


Fig. 24. (Above) Basic components of motor circuit designed for one motor only. Fig. 25. (Left) Basic components of a complex motor installation involving a number of motors of various sizes.

cuit overcurrent devices, etc., the values given in Tables 21 to 24 of Chapter 10 including footnotes, may be used in lieu of actual current rating marked on the motor name plate."

The footnotes referred to apply specifically to the statement with reference to the use of low speed or high torque a-c single-phase, two-phase and three-phase motors. Motors of this type require a larger running current and may therefore require larger feeder conductors, etc. For example, a 100 hp, three phase, 220 volt normal torque squirrel cage motor has a full load current, according to Table 24, of 246 amperes. This corresponds roughly to a normal speed of 720 rpm. This same motor built to operate at 1800 rpm would require only 230 amperes but at 600 rpm its full load current draft is 254 amperes. The motor designed for 900 rpm and high slip requires 252 amperes. The same size motor designed for high torque and low starting current requires 254 amperes at full load. Motors built for much lower speeds and high torque and high starting current may show even greater increases.

For normal duty motors, the conductors for individual motors should have a minimum capacity, 25% greater than the full load current of the motor. Thus the 100 hp motor referred to above would require a minimum size conductor capable of carrying 1.25 x 246 or 307½ amperes. If type RH wire is to be used then three 350,000 cir mil wires in 3-inch conduit or three No. 3/0 wire on open insulators would be large enough for feeders to the motor.

This gives a minimum size and the Code emphasizes this by means of a fine print note (page 154), Thus the 350,000 cir mil feeder could be extended about 180 feet for a 3% drop at full load whereas the 3/0 feeder could only be about 100 feet long for the same drop. Table 20 of the Code, in columns 2, 3, and 4, shows the wire sizes corresponding to a 25% overload capacity based on the full load current of various motor sizes. Each column is based on the use of wire in a raceway.

If the feeder supplies two or more motors, the capacity of the feeder must be equal to the running current of all the motors plus 25% of the running current of the largest motor. For example, assume that fifty 25 hp, 440 volt, three-phase squarrel cage motors are to be supplied. Table 24 indicates the full load running current to be 32 amperes. The feeder must have a minimum capacity capable of carrying a current equal to that shown by the following calculation:

1 motor @ 1.25 x 32 amp.= 40
49 motors @ 1.00 x 32 amp.=1568
Total, 1608 amperes.

Disregarding voltage drop, the minimum size feeder would be three 2,000,000 cir mil Type AVA cables (Table 2, N.E.C., capacity 1713 amps.) on open insulators, or three feeders each consisting of three 1,000,000 cir mil type RH cables in 4-inch conduit (Table 1, N. E. C., capacity 1629 amps.) or any other combination of bus bars, cables, etc., having a minimum capacity of 1608 amperes.

It should be noted that only one motor is calculated for 25% overload. On several occasions there has come to the attention of the writer installations wherein 25% was taken on the total running currents of all motors, i.e., 1.25 x 50 x 32 = 2000 amperes. This, of course, is wrong and does not follow the intent of the Code.

In most installations the entire load is subdivided into several subfeeders. Thus in the above case it may be necessary to divide the

load into two sections of 25 motors each. Then each sub-feeder must have a capacity equal to that shown in this calculation:

1 motor @ 1.25 x 32 amp.= 40
24 motors @ 1.00 x 32 amp.= 768
Total, 808 amperes.

Three 800,000 cir mil Type RH cables on insulators would provide minimum capacity for each feeder (Table 2, N.E.C.).

Each individual motor feeder from the subdistribution panel must be capable of carrying a minimum of 40 amperes. Therefore, each branch circuit feeder could be three No. 6 Type R wires in 1¼-inch conduit. Figure 26 illustrates the feeder system for the above load.

In installations having motors with various ratings, the same principle is used. Thus a circuit supplying a 50 hp, three-phase, 220 volt wound-rotor motor, a 60 hp, three-phase, 220 volt squirrel cage motor, and a 30 hp unity power factor synchronous motor would require the feeder and individual branch circuit minimum sizes shown in the following:

50 hp, 3-phase, 220 V., W. R. full load current = 125 amps.
40 hp, 3-phase, 220 V., S. C. full load current = 101 amps.
30 hp, 3-phase, 220 V., Syn. full load current = 65 amps.

Main feeder minimum size:
1.25 x 125 = 156¼ amps.
1.00 x 101 = 101 amps.
1.00 x 65 = 65 amps.
Total = 322¼ amps.
3—750,000 cir mil Type R in 3½-inch conduit would serve as a minimum size feeder.

Branch circuit minimum size:
For 50 hp = 1.25 x 1.25 = 156¼ amp.; use 3—2/0 Type RH in 2-inch conduit.
For 40 hp = 1.25 x 101 = 126 amp.; use 3—1/0 Type SN in 2-inch conduit.
For 30 hp = 1.25 x 65 = 81¼ amp.; use 3—No. 1 Type R in 1½-inch conduit.

In the above examples no attempt is made to present a practical solution. Various types of wires would not be used as indicated. This is done to show the different combinations that are available based only on minimum current carrying capacity and not on the most efficient system from the standpoint of voltage drop and cost of wiring.

Certain operations within a plant may require motors to be operated on a non-continuous cycle. The Code lists and defines four such types of operation:

(a) Intermittent duty wherein operation is on alternate intervals (not necessarily regular intervals) of one of the following type: (1) load and then no load, or (2) load and rest, or (3) load, no load and rest.

(b) Periodic duty is intermittent duty wherein the cycles are recurring at regular intervals.

(c) Short time duty requires service at a constant load for a definitely specified short period of time.

(d) Varying duty requires service for loads which may vary over a wide range within the hp capacity of the motor and may require the varying loads to be on for periods of time which vary greatly.

Intermittent duty is illustrated by elevator, crane, drawbridge motors, etc. Periodic duty would be found in motors operating hoists, mill rolls, etc. Short time duty would be involved in rasiing operating valves on handling of mill rolls.

The table on page 154 of the Code shows the percentage of full load current which must be used to determine the minimum feeder size for motors operating on duty cycles as outlined above. In this table, the rating is broken down further into four time classifications. All motors are required to have this time rating included on the name plate. This rating indicates the length of time required for the motor to reach its rated temperature when started cold with full load operation.

Thus a 5 minute, 55° C rise, 50 hp motor would reach its 55° C rise above ambient (average room

(Continued on page 52)

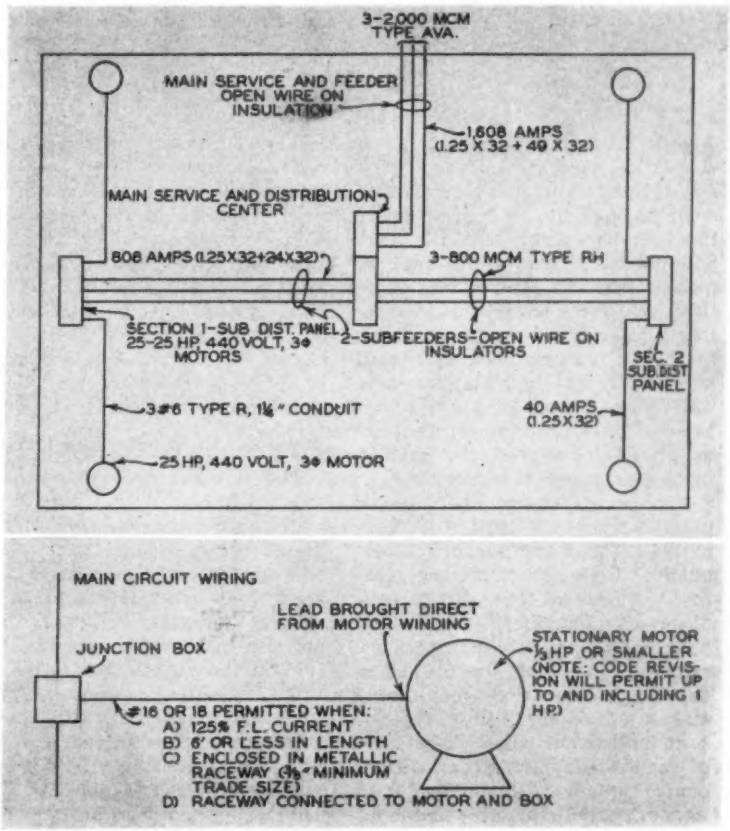
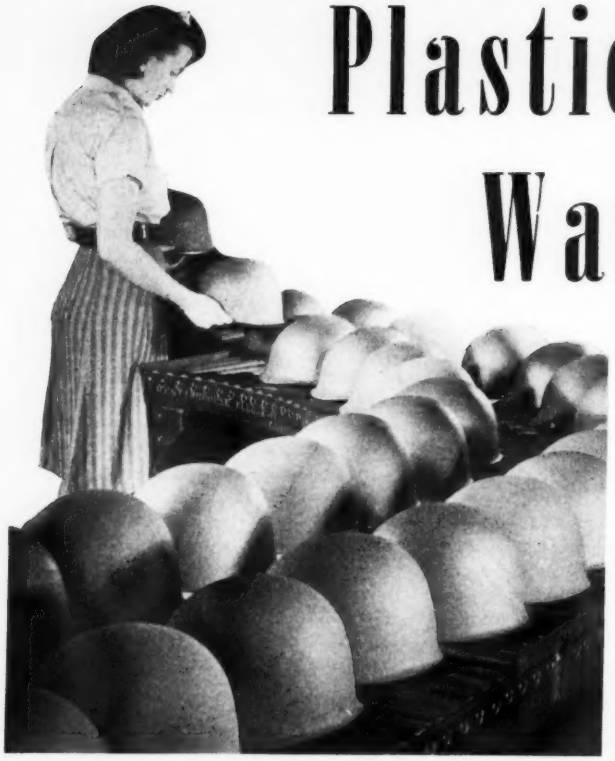

3-2,000 MCM TYPE AVA.
MAIN SERVICE AND FEEDER OPEN WIRE ON INSULATION
1,608 AMPS (1.25 X 32 + 40 X 32)
MAIN SERVICE AND DISTRIBUTION CENTER
808 AMPS (1.25X32+24X32)
3-800 MCM TYPE RH
SECTION 1-SUB DIST. PANEL 25-25 HP, 440 VOLT, 3φ MOTORS
2-SUBFEEDERS-OPEN WIRE ON INSULATORS
SEC. 2 SUB DIST PANEL
3#6 TYPE R, 1¼" CONDUIT
40 AMPS (1.25X32)
25 HP, 440 VOLT, 3φ MOTOR
MAIN CIRCUIT WIRING
LEAD BROUGHT DIRECT FROM MOTOR WINDING
JUNCTION BOX
STATIONARY MOTOR ½ HP OR SMALLER (NOTE: CODE REVISION WILL PERMIT UP TO AND INCLUDING 1 H.P.)
#16 OR 18 PERMITTED WHEN:
A) 125% F.L. CURRENT
B) 6' OR LESS IN LENGTH
C) ENCLOSED IN METALLIC RACEWAY (⅜" MINIMUM TRADE SIZE)
D) RACEWAY CONNECTED TO MOTOR AND BOX

Fig. 26. (Above) Typical installation described in accompany discussion showing method of determining minimum size feeders, subfeeders and branch circuits. Fig. 27 (Below) Diagram illustrating conditions under which stationary motors of ½ horsepower or below may be served from feeders of No. 16 or No. 18 wire. (Pending Code revision will permit up and including 1 horsepower stationary motors under these conditions.)

Plastics Are War Materials

By E. S. Edwards
Westinghouse Research Laboratory



Plastics can no longer be considered substitutes for strategic materials, but they hold great promise for the electrical industry after the war is won. An example is the possibility of refrigerators formed of plastic serving as both structural unit and thermal insulation.

Typical application of plastic materials to war products is this mass production of light, one-piece plastic helmets for the armed forces. These are plastic liners designed to fit inside a steel shell used for combat wear.

PLASTICS play a vital part in this Second World War. They are made with many different combinations of physical properties. Light weight, strength, heat and electrical insulation, ease of moldability and fabrication, make them useful for many applications, in all branches of warfare. These applications have been increased at a rapid pace and plastics have taken their place along with aluminum, copper, zinc, nickel, chrome, magnesium, steel and other metals, in the existing emergency.

Five important applications of plastics were developed in 1941 for use in bomber and pursuit planes, namely: Transparent methacrylate resin in nose section, gun turrets, observation hatches, and tail empennage; radio-antenna mast assemble, molded of phenol-formaldehyde composition, containing macerated fabric filler; fluorescent instrument panels fabricated of laminated plastics; an aileron control quadrant molded of high impact phenolic plastic; and molded cabin ventilator which combines economy and speed in production with freedom from corrosion.

Considerable attention was devoted to the utilization of certain natural products in extending the available supplies of molding powders. Of primary interest was lignin, recovered as a by-product in the pulping of wood; soy bean protein, which has been used in conjunction with phenolformaldehyde resin and wood flour in the molding of automotive parts; and bagasse, the residual crushed fiber of sugar cane after the sugar-containing juice has been removed.

Industry's Outstanding Development

The outstanding development in molding was in continuous extrusion, which provided plastics in decorative and structural shapes to replace aluminum, stainless steel, and other metals reserved strictly for war purposes. This material has a particular application in the architectural field, as table-top edging and interior trim, in conjunction with tile board, linoleum, and other materials.

A special orientation process was perfected, capable of making continuous rattan-like strips of greater strength, flexibility, and fatigue life than the natural product. The woven plastic strip is used as seat upholstery in cars and busses, theaters and public buildings, and replaces foreign supplies of such raw materials as rattan and reed, which were always expensive and now are unobtainable.

Extruded in the form of fine filaments, plastics are introducing some startling new effects in fields formerly reserved for textiles made from vegetable fibres. Plastic sheeting is also displacing textile in garment bags, umbrella coverings, raincoats, shower curtains, hats, shoes, belts, suspenders, piece goods for curtains, and the like.

The successful operation of the rubber-bag molding process for the fabrication of aircraft structures from synthetic resins and wood veneers has demonstrated that it is a practical method for producing airplanes, using materials and labor which are more readily available than those required for metal aircraft. Resin-bonded plywood was also used extensively in war housing and in small-boat construction.

Phenols Most Valuable

Of all the plastic materials, phenol-formaldehyde or thermosetting products find the widest use. They are light in weight, stable under rapid temperature

and relative humidity changes, good insulators, high in impact values and impervious to weathering.

Laminated and fiber-filled phenolics are being used where greater strength and higher impact are required.

Non-metallic bearings have rapidly assumed a position of importance in machine design, giving satisfactory performances under conditions that have limited the usefulness of metallic bearings. Many of the non-metallic bearings are fabricated from canvas-reinforced laminated phenolics and molded from phenolic compositions with self-lubricating fillers. Such bearings have the ability to operate in water in absence of oil or grease, are quiet in operation and effect a reduction of power cost.

Another well known application of plastic materials is in the field of non-metallic gears and pinions. Gears of every description and size have been made of plastics, both in molded and laminated form. They are used in conjunction with metallic gears, for seldom are two plastics operated together.

Non-metallic cams in timing devices constitute another field of application. In devices of this nature, the movement of the cam may be put to work in controlling a number of timing elements, making and breaking circuits at definite intervals. In such devices as electrical distributors for automotive electrical ignition systems, high-speed, non-metallic cam-tripping mechanisms are subjected to severe service. Operating against a heavy spring pressure, these laminated phenolic plastic cams must possess high resistance to impact and a fatigue limit considerably above the mechanical stresses encountered during operation. The dielectric qualities of the material simplify the design, as the cam does not have to be insulated from the driving shaft.

Another item which presented a problem of chemical resistance and high mechanical strength was the rayon spinning bucket. These buckets are approximately eight inches in diameter and spin on a vertical shaft at 8,000 rpm as the wet rayon yarn is fed into the top and caked around the inner wall. A load of yarn weighs approximately three pounds so that the bucket must have sufficient strength to withstand the stress caused by the centrifugal force created by the mass of rayon and the bucket itself. A combination of macerated duck and laminated sheet solved the problem nicely.

And so the list grows; including aircraft pulleys, suction box covers on paper machines, helmets, ball-bearing retainer rings, pump parts and a host of others.

Electrical Uses Grow

Developed primarily for the electrical industry, it is natural that plastics should be applied to a large number of electrical machines. Generally, the insulating properties of plastics are utilized in some manner; molded and laminated plastics are both used extensively, fulfilling specific needs. Here are some typical applications:

Audio-Frequency Oscillator. The major components of the oscillator are assembled on a block of laminated phenolic plastic material. Black paper-base laminated material is used. It possesses good machining qualities, high electrical insulation and a smooth surface. No insulation is required other than that provided by the laminated phenolic plastic.

Commutator Brush Ring. The application of molded or laminated plastics as insulation for electrical current-carrying, current-collecting and current-terminal parts in electrical machines is a long established practice. Most of these features are embodied in the form

(Continued on page 52)

Like a miniature snow storm, powdered plastic flies from a milling machine as slots are grooved in an insulator support. Made of layers of resin-treated cloth or paper moulded under 225-ton pressure, it is so strong that a high-speed tool cutter is required for this notching operation. It is used to make many diversified items such as bearings, powder boxes for coal miners, automobile timing gears and as construction material for planes, ships and guns.

Conservation-Utilization Plan Keeps Equipment in Use

UP IN Northwest Arkansas, in a garage, there was a small electric motor that had not been used for several months, although in excellent running condition.

Down in Little Rock, the motor on a commercial refrigerator burned out. The proprietor could not get a new one because of the scarcity of such items caused by the war.

Yet he was not greatly disturbed. Within a few minutes he had learned of the motor in Northwest Arkansas, had telephoned the owner, arranged a trade, and by nightfall had received it. Instead of his refrigerator being out of use for the duration, its operation was halted only a few hours.

This is but one instance of how the new Equipment Conservation and Utilization program of the Arkansas Power and Light Company is working. The program has already produced excellent results, according to P. C. Tucker, general sales manager, under whose supervision the program was drafted and is being operated.

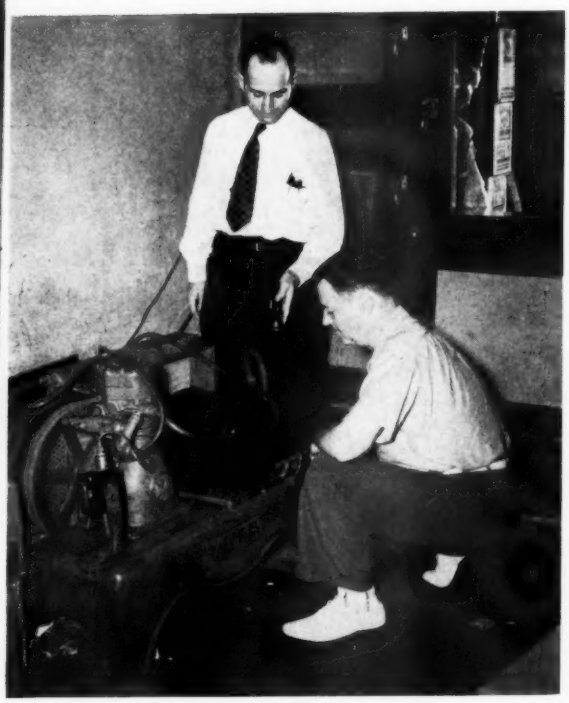
Sales Department Activity

To carry out the program seven members of the Sales Department have been assigned to the Equipment Conservation and Utilization Division. Each employe is assigned to a division, which includes several cities and towns.

"Early in the war it was realized that unusual steps would be needed if important peacetime operations continued since so much time and materials would be required for the production of armaments," Mr. Tucker said in explanation of the plan. "Our company decided that full use should be made of all existing equipment. We knew that to obtain maximum benefits from this equipment a well defined conservation program would be required, including an idle equipment inventory."

The sales department representatives engaged in this program spend all their time calling on manufacturing plants, garages, restaurants, drug stores, and other business establishments that operate any kind of electrical equipment.

Each power company representative carries a flashlight, and in company with the owner or superintendent, inspects the various items of equipment. The flashlight is used to focus the atten-



Above, Marshall Spillyards, who has charge of the Arkansas Power and Light Company's conservation and utilization program in the Little Rock division, obtains data for "idle equipment inventory" maintained by the Company. Right, attention of grocer is directed to parts of refrigerator compressor that require regular maintenance attention.

tion of the business head on faulty equipment parts or on poor maintenance conditions that may be found. Information on proper maintenance methods is given, and on each inspection the power company representative leaves a blank card for the operator to use in recording maintenance data, such as the date of oiling or repairing the equipment. Another blank card for recording the date that lighting fixtures are to be cleaned is also left.

Then the sales department representative compiles an inventory of all idle equipment or parts that may be available. "The requirements of the war effort for certain types of critical metals and manufacturing equipment have made it difficult, and in many instances impossible, to get replacements or repair parts for mechanical equipment in civilian use," Mr. Tucker explained. "Therefore the matter of prolonging to the greatest possible extent the life of such equipment is a matter of importance to all businesses."

Convenient Forms Used

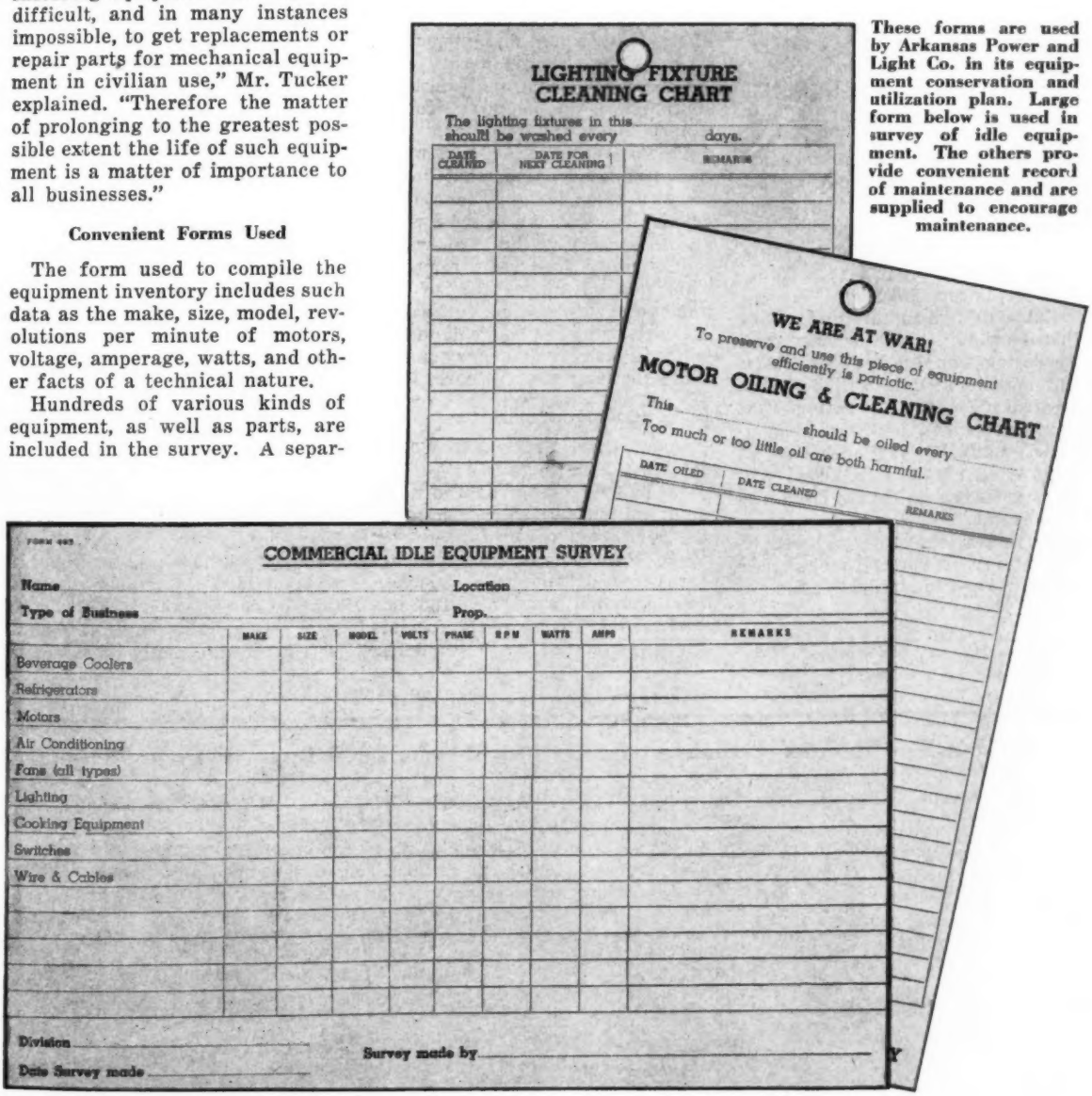
The form used to compile the equipment inventory includes such data as the make, size, model, revolutions per minute of motors, voltage, amperage, watts, and other facts of a technical nature.

Hundreds of various kinds of equipment, as well as parts, are included in the survey. A separate file card is compiled on each business visited. Each day the sales department representative compiles a list of all the pieces of equipment and parts found and sends it to the division sales manager. These reports list the prices desired for the equipment by the owners if they care to sell.

The division reports are sent to the general sales manager, and a complete report made of all equipment in the company's territory, which includes about 56 of the State's 75 counties. These complete reports are then sent out to the division sales managers, who in turn make them available to local managers of the power company. They are available to all customers of the company who may be in need of some article or some part.

The utility does not participate in actual sales other than to bring together the two customers needing and having the item.

"Many instances have already been reported of beneficial use being made of this equipment," Mr. Tucker said. "The program serves the purpose of enabling customers who need equipment to get it second-hand at a time when new items are not available, and at the same time, it enables those customers who have money tied up in idle equipment to realize something on their investment by selling it."



These forms are used by Arkansas Power and Light Co. in its equipment conservation and utilization plan. Large form below is used in survey of idle equipment. The others provide convenient record of maintenance and are supplied to encourage maintenance.

Three-Phase Winding Design For Old Motor Frames

By A. C. Roe*

THERE ARE numerous cases where a repair shop has an old frame without a winding or name plate for which they would like to design a winding; other cases where they have a motor with winding but would like to obtain a winding that would produce the maximum horsepower rating obtainable from the frame; or other cases where they have a single-phase motor and want it rewound for three-phase operation.

In this article we will provide some practical data that will enable the repair man to check existing frames and design a workable winding. The various design factors provided are conservative but any repair shop can check windings on hand or old winding data cards and establish a set of factors for closer work.

All windings in this article are based on 40° C rise or maximum operating temperatures of 90° C but additional data will be given regarding maximum rating that can be obtained for Class B insulated windings for operation at 140° C or 100° C rise. This will permit maximum rating from any one frame.

Requests frequently are received by repair shops to change a single phase induction type motor to a three-phase winding. In such cases, the core, frame, rotor, etc., is available and the question is what rating can be expected in such cases on three-phase operation.

A single-phase motor frame is 1.5 times the size of a corresponding three-phase motor of the same horsepower and speed, which means that when changing from single-phase to three-phase, with the speed remaining the same, the single-phase horsepower rating can be increased 1.5 times.

There is another and better method for determining what horsepower a given frame is capable of developing, that can be used when an old core is available on which the winding has been removed. This method makes use of the number of "cylindrical inches" in the core, using the inside diameter, which is the bore diameter squared times the length of the core. Thus (B x B x L) determines the maximum horsepower rating of any frame. (See ELECTRICAL SOUTH for July, 1942, page 38.)

In Table I are given the minimum cylindrical inches allowance for each horsepower rating from ¼ to 7½. The values given are for cores of four-pole, 60-cycle, 1800 rpm motors. In a footnote under Table I is given the formula for determining the cylindrical inches required for six, eight and ten pole, 60-cycle motors.

Table II gives some values taken from rewound motors. These values can be used as comparisons or checks.

For example, assume we have a stator that has a bore of 6 inches and a core length of 2½ inches. What are the cylindrical inches, and what horsepower rating will it have? First, 6 x 6 x 2.5 = 90 cylindrical inches. Then Table I shows that this frame is suitable for 3 hp at 1800 rpm, 60 cycles; or 3 ÷ 1.5 = 2 hp at 1200 rpm, 6 pole; or 3 ÷ 1.85 = 1½ hp at 900 rpm, 8 pole; or 3 ÷ 2.7 = 1.11 hp at 720 rpm, 10 pole. Thus the factors in Table I can be used to find the cylindrical inches required at each speed or horsepower rating of any core within its limits. Any repair shop can build up a table similar to Tables I and II from motors rewound, extending the horsepower and speed range to any limit.

The next step is to determine the number of turns, size of wire, and coil pitch. To get the turns, the flux per pole per phase must be figured. This is done by the use of the formula (0.636 x S_1 x L x Bm), where S_1 is the pole pitch which is equal to (bore x 3.14) divided by number of poles (values for S_1 are given in Table III). L equals length of core, that is, actual length of iron, not

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Table I—Minimum Cylindrical Inches* for 4-Pole, 1800 Rpm, 60-Cycle Motors

Cylindrical Inches*	Rating in Hp.	Cir Mils per Ampere
12	¼	320
20	⅜	375
25	½	450
30	¾	475
40	1	500
55	1½	525
75	2	550
90	3	600
120	5	650
200	7½	675

*The term "cylindrical inches" is used in motor design to designate the product B x B x L, where B is bore diameter in inches and L is the length of iron in core in inches. The cylindrical inches, as calculated in this manner, is a convenient guide to the horsepower rating of a motor frame. The values given in the table are for 4-pole motors. Multiply these values as follows to obtain data for motors having 6 to 10 poles:

Multiply by 1.5 for 6 poles

Multiply by 1.85 for 8 poles

Multiply by 2.70 for 10 poles.

including ventilating ducts or endplates. Bm is the magnetic density in the air gap in lines per square inch and runs from 20,000 to 30,000 for motors up to 7½ hp with closed slots. A good average value for four and six poles is 25,000 lines per sq. in.; for an eight pole motor, 20,000 lines per sq. in.

As an example, the flux per pole per phase for a 6-inch bore by 2½-inch core length would be figured as follows: S_1 is 4.712, and the flux equals (0.636 x 4.712 x 2.5 x 25,000) or 187,250 lines for a four pole winding.

The next step is to check the magnetic density in the iron below the slots, to determine whether the core is suitable for the number of poles. It will be found that in motors designed for slow speed or large number of poles, the depth of iron below the teeth and slots is small, whereas high speed motors have a greater depth of iron. This check is most important, as it determines the number of poles and maximum horsepower rating obtainable from any given frame.

A safe value for magnetic density is 75,000 to 100,000 lines per square inch. A safe average value would be 82,000 lines per square inch.

The square inches per pole is length of core, L, times depth of iron, D, below slots times 2 or (L x D x 2). In this case, D equals 1⅜ inches, and the square inches per pole equals 2½ x 1.375 x 2 = 6.875 sq. in. Then density per sq. in. equals (187,250 x 3) ÷ 6.875 = 81,708 lines per sq. in. which is within safe limits. Note that 187,250 is the lines per pole, per phase, and to obtain total flux per pole we multiply by three.

To help in estimating the size of wire required Table IV is used. This table gives the ampere rating for 220 volt, 3 phase motors. For 110 volts, multiply these values by 2; for 440 volts, divide by 2; for 550 volts multiply by 0.4. Another safe average rule is to allow 1 ampere per horsepower for 550 volts, 3 phase, and then convert to required voltage. For example, 3 hp, 550 volts equals 3 amperes. For 110 volts the amperes are equal to (550/110) x 3 = 15 amps. Checking Table V, we find for 3 hp, 220 volts, 8.1 amperes or for 110 volts we have 2 x 8.1 = 16.2 amperes which is quite close to the rough rule of 15 amperes.

In the following examples we will use 80 per cent of coil pitch. The coil pitch will equal (number of slots divided by number of poles times .8) or for 48 slots, 4 poles, the coil pitch is (48/4) x .8 = 9.6, or pitch would be 1 and 10.

The next step is to figure the turns required per phase, and for three-phase motors there are two possible connections as star and delta, and the two formulas given include all factors for chord factors, etc.

(A) For a three-phase *series-delta* connection, the turns per phase, T, equals (E x 100,000,000) ÷ (4.25 x F x f). Where E equals the line voltage; F equals the total flux per pole per phase; and f equals the frequency. Then the turns per coil is equal to T divided by the number of coils per phase.

(B) For a three-phase *series-star* connection the turns per phase, T, equals (E x 100,000,000) ÷ (7.35 x F x f). Note in both formulas A and B, use E as line voltage as the factors used reduce the line voltage to voltage per phase as needed.

A series-star connection requires less turns of larger wire, and a series-delta connection a greater number of turns of smaller wire. The majority of motors are star-connected. So the safe procedure is to figure out the turns for a series-star connection and then if the wire is too large try a series-delta connection.

We will next work out one example: First, assume a stator having a 6-inch bore and 2½-inch length of iron. This motor is good for 3 hp at 1800 rpm. When it is to be operated three-phase, 220 volts, 60 cycles, the flux per pole, per phase equals (0.636 x 4.712 x 2.4 x 25,000) or 187,250 lines.

Table II — Typical Values of Cylindrical Inches Computed From Rewound Motors

Hp	Poles	Bore	Length	Cylindrical Inches
¼	4	3¼	2⅛	22.49
⅜	6	5	2¼	56.25
½	4	3⅝	2⅜	31.21
¾	4	4⅜	1⅝	31.10
1	4	4¼	2½	45.15
1	4	5¼	2	55.12
1	6	5	3	75.00
1	6	5⅞	2⅛	73.35
1	10	7	2¼	110.25
1½	6	5⅛	3⅛	82.08
2	4	6	2½	90.00
2	4	5	3	75.00
2	4	5¼	3¼	89.57
2	6	6	3	108.00
3	4	5⅝	3⅛	98.88
3	6	7	3⅛	153.13
5	4	6⅝	2⅞	126.18
5	4	7⅛	3	152.31
5	6	8	3⅜	216.00
5	8	9½	3¾	338.44
7½	?	8	4¼	272.00
7½	6	8½	4¾	316.09

Table III—Values of Pole-Pitch in Inches For Various Sizes of Bore

Bore in Inches	Bore Times 3.14	S_1 = Pole Pitch in Inches 2-Pole	4-Pole	6-Pole	Bore in Inches	Bore Times 3.14	S_1 = Pole Pitch in Inches 2-Pole	4-Pole	6-Pole
2½	7.85	3.975	1.987	1.325	6	18.85	9.425	4.712	3.141
2⅝	8.25	4.125	2.062	1.375	6⅛	19.24	9.620	4.810	3.206
2¾	8.64	4.320	2.160	1.440	6¼	19.64	9.820	4.910	3.273
2⅞	9.03	4.515	2.257	1.505	6⅜	20.03	10.015	5.007	3.338
3	9.42	4.710	2.355	1.570	6½	20.42	10.210	5.105	3.403
3⅛	9.82	4.910	2.455	1.636	6⅝	20.81	10.405	5.202	3.468
3¼	10.21	5.105	2.552	1.701	6¾	21.21	10.605	5.302	3.535
3⅜	10.60	5.300	2.650	1.767	6⅞	21.60	10.800	5.400	3.600
3½	10.99	5.495	2.747	1.831	7	21.99	10.995	5.497	3.665
3⅝	11.39	5.695	2.847	1.898	7⅛	22.38	11.190	5.595	3.730
3¾	11.78	5.890	2.945	1.963	7¼	22.78	11.390	5.695	3.796
3⅞	12.17	6.085	3.042	2.028	7⅜	23.17	11.585	5.792	3.861
4	12.57	6.285	3.142	2.095	7½	23.56	11.780	5.890	3.926
4⅛	12.96	6.480	3.240	2.160	7⅝	23.95	11.975	5.987	3.992
4¼	13.35	6.675	3.337	2.225	7¾	24.35	12.175	6.087	4.058
4⅜	13.74	6.870	3.435	2.290	7⅞	24.74	12.370	6.185	4.123
4½	14.14	7.070	3.535	2.356	8	25.13	12.565	6.282	4.188
4⅝	14.53	7.265	3.632	2.421	8⅛	25.53	12.765	6.382	4.255
4¾	14.92	7.460	3.730	2.486	8¼	25.92	12.960	6.480	4.320
4⅞	15.32	7.660	3.830	2.553	8⅜	26.31	13.155	6.657	4.385
5	15.71	7.855	3.927	2.618	8½	26.70	13.350	6.675	4.450
5⅛	16.10	8.050	4.025	2.683	8⅝	27.10	13.550	6.775	4.516
5¼	16.49	8.245	4.122	2.748	8¾	27.49	13.745	6.872	4.581
5⅜	16.89	8.495	4.247	2.835	8⅞	27.88	13.940	6.970	4.646
5½	17.28	8.640	4.320	2.880	9	28.27	14.135	7.067	4.711
5⅝	17.67	8.835	4.417	2.945	9⅛	28.67	14.385	7.192	4.795
5¾	18.06	9.030	4.515	3.010	9¼	29.06	14.530	7.265	4.843
5⅞	18.46	9.230	4.615	3.076	9⅜	29.45	14.725	7.362	4.908
					9½	29.85	14.925	7.462	4.975

Then for a series-star connection, T per phase equals (220 x 100,000,000) ÷ (7.35 x 187,250 x 60) equals 266 turns. As this stator has forty-eight slots, we will use a two-layer, diamond-shape mush coil. There will be forty-eight coils, or 48 ÷ 3 equals 16 coils per phase. Then the turns per coil equal 266 ÷ 16, equals 16.6; sixteen turns will be close enough.

By Table V a 3 hp, 220-volt, four pole motor will take 8.1 amp. From Table I, we find a 3 hp motor requires 600 cir mils per ampere. This size of wire in cir mils equals 8.1 x 600 or 4,860 cir mils. Then from wire Table V, we find the nearest size is No. 14 with 4,107 cir mils, or No. 13 with 5,178. No. 14 will do, but if there is enough room in the slot for No. 13, it would make a more efficient motor.

The best method of determining whether an estimated size of wire can be wound is to insulate one slot; then cut up small lengths of wire of the gauge size figured and fill the slot with the required number of turns. In this case we would try 2 x 16 or 32 size No. 14 double-cotton covered wires.

When the size of wire required is above No. 15 and it is desired to make a mush coil, the better procedure would be to double the turns, halve the size of wire and use a parallel connection. This makes a coil that is easier to handle and shape. In this case, we could use thirty-two turns of one No. 17 wire per coil and connect for two-parallel star.

When a delta connection is used the amperes per terminal, as given in Table IV, must be divided by 1.73 to get the amperes per phase. Or in the case just figured, 8.1 ÷ 1.73 equals 4.624 amp. Then the cir mils required equals 4.624 x 600 or 2,774.4—use No. 16 wire.

Another and better method of figuring the size of wire in cir mils for a delta connection is to take the value given in Table IV for the proper voltage and multiply it by 0.57. Then multiply this answer by the cir mils allowance given in Table I for the required horsepower rating. In the case just figured (8.1 x .57 x 600) equals (4.617 x 600) or 2,770.2, which is close enough.

The next step is to find the coil pitch. This equals 1 and (1 + 48/4 x .8) or 1 and (1 + 12 x .8) equals 1 and 10.6, or 1-and-10.

The method outlined above can be used for all three-phase machines. All unnecessary calculations have been eliminated, the purpose being to enable the average electrician to develop a motor that will run and carry its rated load satisfactorily and with reasonable efficiency.

The rotor can be used as it is, but see that all joints between end-rings and bars make good contact. The cutout switch used on the single-phase winding should be removed.

Class B Insulation Ratings

All preceding data has been based on ratings for windings using Class A insulation, but in cases where the maximum obtainable rating is required from any frame, proceed as above and find the turns and size of wire by the formulas. Then check the slot space and end room for the maximum size wire that can be used.

For example, use a star connection when possible as this keeps the turns low and wire insulation to a minimum. In our data above the formula indicated that 4107 cir mils was needed. Then if we were able to use a No. 13 wire, the cir mils used would be 5178 cir mils or an increase of 26%. Thus using No. 13 wire and all Class B insulation, we could increase the rating to 3 + [3 x (.26/2)] + (3 x .1) or the full Class B insulation rating with the larger wire would be approximately 3¾ hp.

Or we can increase the rating 10% by changing from Class A to Class B insulation. Then for each one per cent increase in copper area we can increase the rating a half of one per cent. A rough rule is that the Class B rating amperes will increase 15 per cent over the normal 3 hp Class A insulation rating.

The preceding data, if carefully used, will provide workable windings and permit the rewinding of any given frame for its maximum rating.

Table IV—Ampere Ratings for 40 Deg. Three Phase Motors.

Hp.	Poles	Amp. per Terminal
¼	4	.90
½	4	1.61
½	6	1.90
½	8	1.92
¾	4	2.33
¾	6	2.48
¾	8	2.65
1	4	2.95
1	6	3.02
1	8	3.60
1½	4	4.42
1½	6	4.48
1½	8	5.15
2	4	5.7
2	6	6.0
2	8	7.9
3	4	8.1
3	6	8.7
3	8	9.7
5	4	13.1
5	6	13.6
5	8	14.1
7½	4	19.1
7½	6	19.5
7½	8	20.6

Table V — Size, Diameter and Area of Round Bare Wires

Size B & S Gauge	Diameter	Area	
	Bare	Sq. In.	Circ. Mil
1	.2893	.06753	83690
2	.2576	.05213	66370
3	.2294	.04134	52630
4	.2043	.03278	41740
5	.1819	.02600	33100
6	.1620	.02062	26250
7	.1443	.01635	20820
8	.1285	.01297	16510
9	.1144	.01028	13090
10	.1019	.00815	10380
11	.0907	.00647	8234
12	.0808	.00513	6530
13	.0720	.00407	5178
14	.0641	.00323	4107
15	.0571	.00256	3257
16	.0508	.00203	2583
17	.0452	.00161	2048
18	.0403	.00128	1624
19	.0359	.00101	1288
20	.0320	.00080	1022
21	.0285	.00064	810.1
22	.0253	.00050	642.4
23	.0226	.00040	509.5
24	.0201	.00032	404.0
25	.0179	.00025	320.4
26	.0159	.000199	254.1
27	.0142	.000158	201.5
28	.0126	.000125	159.8
29	.0113	.0000995	126.7
30	.0100	.0000789	100.5

Appliance Exchange Service Available

Because of the scarcity of new and used electric refrigerators brought on by the war, the Georgia Power Company offers its customers a new free service of serving as an "information center" on used electric refrigerators. The company stores will maintain a list of used electric refrigerators available from individuals and a list of those desiring to buy.

Assisting buyers and sellers in locating each other, will be the extent of the company's service. It will not undertake to buy or sell the refrigerators, or to act as agent for their sale or purchase. In listing the refrigerator the customer is required to furnish complete data.

Inventory Your Man Power

By Lewis B. Hershey*

MANPOWER is a most important strategic material of today. Every employer should make a prompt inventory, appraisal and analysis of the manpower in his own plant as he would inventory his stock pile. In order to keep production going and at the same time furnish men for the armed forces, industry should now establish an orderly replacement program.

In order to secure temporary deferments for essential men while he is training women, young men, older men, men physically handicapped or those with a high degree of dependency, the employer should know the fundamental principles in the operation of his local Selective Service Board. Certain steps should now be taken by each employer. He should know how many men on his payroll are between the ages of 20 and 45. He should investigate the classification of every one of those men. On the basis of such an inventory he should prepare to plan ahead and train men for replacement of those who must necessarily enter the armed forces if we are to have the sort of Army which can win the war.

Deferments Temporary

Deferments, granted so that employers may train women or men not liable to early induction, are temporary deferments; they cannot exceed six months and in many cases may be for only thirty, sixty or ninety days. The Army today has to train a bomber pilot within a period of eight months to operate a very technical machine with an instruments board which puzzles an expert. Why, therefore, should industry insist that it will require from two to three years to train men for industrial tasks not nearly so complicated?

The fundamental purpose of every deferment of a registrant is to allow an employer to train a replacement. Only in a few rare instances can an employer expect to have these temporary deferments continued for more than the six months period. These are only in cases where an extra long period of training is required for a replacement and the eight months needed in which a bomber pilot can be turned out now, is something to remember in this connection.

Employer's Responsibility

Employers may seek the deferment of their necessary men with or without their consent. Here is how they go about it:

On page three of the Selective Service Questionnaire (Form 40) which is sent to each registrant before he is classified is the following:

> Instructions: If your employer believes that you are a necessary man in a necessary occupation, it is his duty to fill out Form 42A requesting your deferment. You may also attach to this page any further statement by yourself which you think the local board should consider in determining your classification. Such statement will then become a part of the questionnaire.

This is on all the questionnaires distributed during the past six months. The fact that the Selective Service System now specifically mentions the filing of Form 42A as the manufacturers' duty is a clear indication of the Selective Service System view on the responsibility of each employer in this matter.

The employer can secure Form 42A at the local board and the local board will consider the employer's request when the form is properly filled out and signed.

If such request should be denied because the man, after consideration of the claims offered for him, is not considered to be indispensible to the company's operation, and is needed more in the armed services, the local board will advise the employer of its refusal of such an occupational deferment.

The local board does this by sending to the employer, at the same time it notifies the registrant of his classification, a Form 59.

There are ten days after Form 59 is mailed by the local board to the employer during which the employer can appeal the registrant's case.

The registrant will not be ordered to report for induction during this ten-day period.

In order to make an appeal the employer simply has to sign his name to Form 59 which he has received, and return it to the local board; or in case the Form 59 is not received from the local board, any written request will have full value to make such an appeal effective.

When Form 59 is returned by the employer the appeal procedure becomes automatic.

All necessary forms are available at the local board in the employer's immediate vicinity or at the office of the State Director of Selective Service.

If the local board and the appeal board deny the appeal for the occupational deferment of a key man, the employer may then bring the matter to the attention of the State Director at the State Selective Service Headquarters, with the request that the case be reopened or appealed by him to the President.

Employer's Definite Duty

A double duty rests upon the employer. He should personally know what his manpower situation is. He should not leave the job to a minor employee to decide who is necessary. The employer who delegates the task of filing a request for deferment to a clerk, the executive who does not make a complete inventory of his whole plant today, is negligent. Likewise, the employer who files requests for deferment of men who can be replaced by women, or others, is keeping reinforcements out of an Army which is battling for us all. The employer engaged in essential war production who has been required to greatly expand

(*Continued on page 51*)

*Major General, U. S. Army, and Director of Selective Service.

All-Out Appliance Service To See This Dealer Through

DOWN IN New Orleans, Louisiana, there is an electrical dealer, M. T. Wetherbee, of Wand's, Inc., who believes that dealers should stay in their own businesses, or at least some phase of it, for the length of the war.

"Such sidelines as furniture, rugs, general housefurnishings, etc., may help to bring in a few dollars, but they are actually taking the dealer out of the appliance business altogether," he points out, "and when hundreds of dealers turn to substitute merchandise of the same kind, the old competitive situation will be with them again. We believe that we can stay with our list of customers on a purely service basis, selling what equipment we can obtain for reconditioning, and weather the tough war conditions without undue hardship."

Selling both commercial refrigeration to meat markets, grocery stores, delicatessens, etc., and domestic major appliances to homeowners, Wand's, Inc., has had a large yearly volume.

Had Reconditioning Experience

The company introduced profitable reconditioning of trade-in refrigerators in New Orleans during 1938, when Mr. Wetherbee built a reconditioning shop in the rear of the building equipped with complete overhaul equipment, spray booth, parts inventory, etc. With a crew of five mechanics, Wand's, Inc., sold 100 trade-ins the first year, and 250 the second, making a profit on each, and spending from $10 to $25 per unit to put it in shape for a 90-day guarantee.

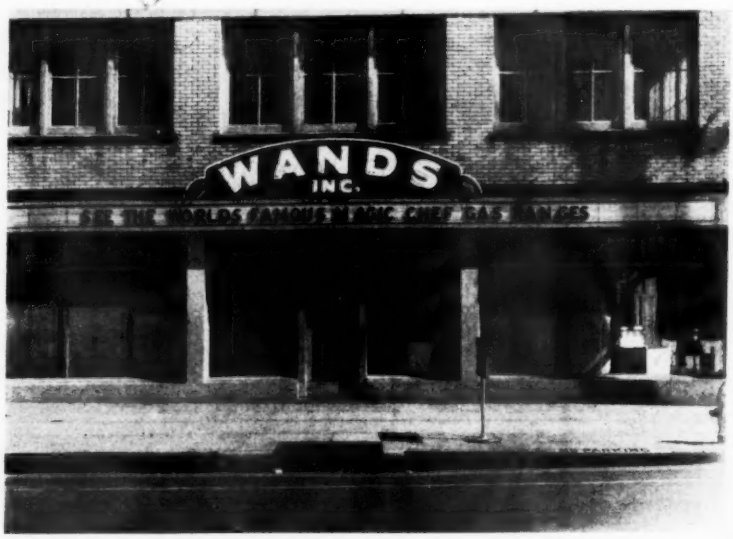
Mr. Weatherbee was doing a more than satisfactory volume until August of 1941 when he foresaw the present conditions, and began to plan for it. He considered substitute merchandise, then discarded the idea for the reasons outlined above. Certain that service and "maintenance repair" for all major and commercial appliances would be the coming thing, he remodelled the entire rear half of the Wand's building into one of the largest refrigeration shops in New Orleans. This was an expensive job, costing $2,000 merely for partitions and extra windows, lighting system and wiring, but worth it from the standpoint of getting work done.

Incidentally, it also meant leasing additional warehouse space two blocks from the main building to hold everything which had been in storage in the rear of the building. Decks thus cleared for action, Mr. Wetherbee installed a complete reconditioning shop, paint shop with two spray booths for large and small equipment, a parts room with specially-designed shelving for accommodating $11,000 in parts and supplies, and a "dispatchers office" with three trunk-line telephone connections for receiving service calls.

"The experience of running a trade-in reconditioning shop went a long way toward helping us in designing an efficient service setup," Mr. Wetherbee said. "We bought well-made equipment to last without expensive repairs, left plenty of room for expansion, and put in extra doors so that we can bring a loaded truck into the building to make repairs without taking it off if necessary. We put in fluorescent lights, showers and a lunchroom space for employees to keep them satisfied with their jobs. Then I hired B. W. Jones, formerly with Kelvinator's service department, to run the service department. I'm a salesman who knows little about service; consequently, I'm not taking chances on botching the job."

Salesmen Sell Service

At the same time, Mr. Wetherbee reduced the sales crew from six to four (two men were on the verge of Army induction, anyway), and hired fourteen additional mechanics, all experienced service men. The four salesmen still on the payroll are selling what appliances are still available, and trade-ins, of which the company still has a large accumulation. When these are gone, the salesmen will sell service by making calls on refrigeration users not already "in the fold." One man is an engineer and bids for and designs government



Exterior of Wand's, Inc., of New Orleans, operated by M. T. Wetherbee. This organization has been converted almost completely into an appliance service business and Mr. Wetherbee believes it will be able to weather the tough war conditions on a service basis alone.

refrigeration, which helps to keep the service installation crew going.

Wand's, Inc., is now whole-hog in the refrigeration service field. Though he didn't advertise the change, merely passing along the information by telephone calls and letters, Mr. Wetherbee averaged between 90 and 125 service calls a day during the closing months of last summer — requiring three telephone girls to merely take orders. Calls were split equally between service on commercial and domestic refrigeration — many of the latter transferred to other firms simply because Wand's was unable to handle them. For all calls, the company has established the rate of $3.00 an hour for the first hour, and $2.50 thereafter — slightly higher than rates prevailing at present, but necessary to pay service men a scale which will keep them from quitting for defense jobs, according to Mr. Wetherbee. Even with salaries ranging above $75 a week (men make $90 with overtime) Wand's, Inc., lost twelve mechanics in six months to Army work.

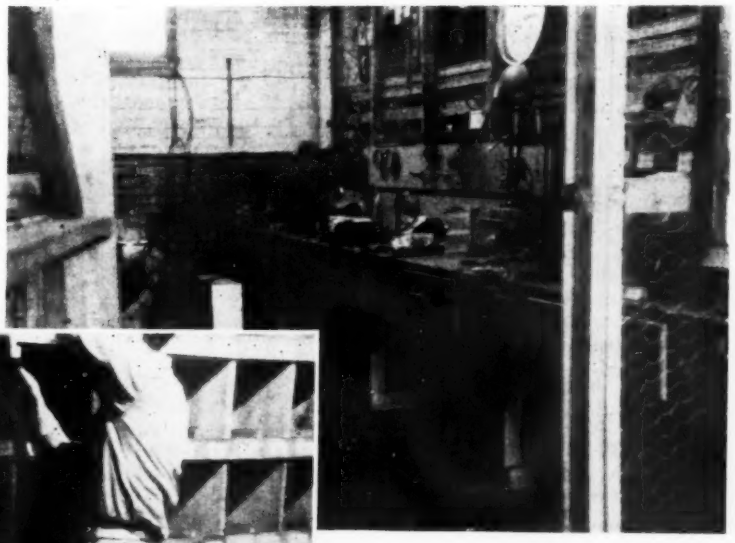
With service help thus a serious problem, Mr. Wetherbee is attempting to develop a crew of 20 experienced men for next summer by training helpers contiguously with regular men. There are nine helpers on the crew, each of whom answers calls, does minor repair work and reconditioning with an experienced veteran, absorbing his training as he goes along.

"We think we can train enough fellows exempt from the draft to meet our personnel needs," Mr. Wetherbee said. "If we can keep them on the payroll in spite of the government's need for such trained men. Our five original shop men are still with us — principal turnover being among new men candidly looking for the most money for their time."

The service rate has shown itself ample to date to keep the company at full peak. No reductions are made except where Wand's has set up a service arrangement with large scale stores. Typical of this are H. G. Hill stores, a chain of 90-odd grocery stores in Louisiana for which Wand's is installing and servicing all refrigeration on an hourly flat rate basis. Mr. Wetherbee also bid for and won a contract for servicing 4,800 domestic refrigerators in a large housing project in New Orleans. On a straight call basis is service for all city-owned markets, obtained largely because Wand's sold most of the refrigeration in them.

Contributing helpfully to keeping the staff busy during last winter was the reconditioning of trade-in refrigerators of all makes, which Wand's purchased from dealers not having shop facilities, bought in the open market, and used commercial equipment also purchased from owners. Mr. Wetherbee found a store closed for several years in which were five pieces of refrigeration equipment, which he bought and sold before they had even been taken down for reconditioning. Old showcases of wood, which in ordinary times would be junked, are now undergoing a face-lifting at Wand's woodworking shop, and are usually sold within 48 hours.

Surprisingly, Mr. Wetherbee has not spent a nickel for advertising. "To put it baldly, we're afraid to advertise," he confessed, "because we got more business than we could handle last summer, and probably will get more calls per day as our business becomes better known. We are going to give preference to commercial refrigeration because it is quicker pay work, and because it doesn't tie up our men's time in the same way widely-separated domestic calls do."



The Wand's management didn't expect service business to just fall in its lap—they made real plans and investments as well. Remodelling of building for handling service work cost nearly $2,000. Parts stocks were expanded tremendously. Other features include refrigerator rebuilding facilities, spray booths, etc. At left, a small part of the supply bins for small parts. Above, one of several work benches.

How Maximum Price Regulations Affect Appliance Service

A SAMPLE statement showing the method which shops servicing electrical and gas appliances and radios must file with their local War Price and Rationing Board has been released by the Retail Trade and Services Division of the Office of Price Administration.

At the same time the Division set forth the four main things which shops supplying these services must do to comply with the Service Regulation (Maximum Price Regulation No. 165, as amended).

Included among services for which this regulation sets top charges (maximum prices) are the repair, maintenance or rental of:

Electrical Appliances (small or portable, commonly used in homes, hospitals, hotels, institutions, offices, retail establishments, or schools)

Electrical household or kitchen equipment whether from or in homes, hospitals, hotels, offices, retail establishments, schools or other institutions (including but not limited to food mixers, ironing machines, lamps, ranges, refrigerators (household), sewing machines, vacuum cleaners, washing machines)

Gas Appliances (except gas furnaces, industrial equipment, unit heaters, or water heaters)

Radios and Phonographs (not primarily designed for commercial, military or police use)

Also included are the prices of all commodities, such as *parts* and *accessories*, when sold in connection with the sale of a service.

The amended regulation covers the maximum price of these services at all levels—retail, wholesale and contract. Prices must not exceed the highest price charged in March for the same or similar service even though prices for labor or material may have increased since then.

Four main things that appliance and equipment service shops of all kinds must do to comply with the Service Regulation are:

(1) Charge no more than you did in March, or charge no more than you would have charged in March for services offered but not sold.

(2) Prepare to the full extent of all available information and records and thereafter keep for examination by any person during ordinary business hours a statement of your highest March prices. File a duplicate of this statement with your War Price and Rationing Board.

(3) Keep all records showing prices charged or offered during March.

(4) Give sales slips and receipts as required by the regulation.

While details of these requirements are given fully in the Services Price Regulation, a brief description is given here.

(1) Maximum Prices.

If you charged a flat or definite amount for a specific service in March, that is the most you may charge now for that same service. Thus, if you charged $1.50 to clean and adjust burners on a gas range, that is your ceiling.

On all service work which in March you priced according to a regular rate or pricing method (such as time records or labor manual used in connection with an hourly customer rate), you may use that rate or pricing method in determining your maximum prices for such services. But the rate or the charges for each item in the service (labor, material, etc.) must be limited to those in effect in March, 1942. For example, you repair washing machines. In March it was your practice to charge $1.50 an hour for labor, profit and overhead, plus the cost of parts at the manufacturer's list price. In March you did not happen to replace a leaky tub, but if you had done so, you would have priced it by your usual method. Your ceiling price for replacing a leaky tub is now $1.50 an hour for labor, overhead and profit, plus the manufacturer's price, as quoted in March, for parts.

You may not make an extra charge for delivery or any other part of the service which was included in your March price.

You must continue to give the same discounts and allowances which it was your custom to give in March.

(2) Records.

Keep all records of any kind which have any bearing on prices you charged in March. Such records would include duplicates of customers' sales slips, invoices, work orders; also posters, display cards, advertisements, letters, post cards, etc., in which service prices were quoted.

(3) Statement of Maximum Prices.

Prepare two copies of a statement of your ceiling prices for your services. These should have been ready by September 1, 1942. One copy must be kept in your place of business for public inspection. The other should have been filed with your local War Price and Rationing Board not later than September 10.

This statement may be prepared on your own stationery or on plain white paper, and should contain the following: (a) A list and a description of the services you supplied during March, 1942, for which you regularly quoted prices in that month; (b) The highest prices you charged for these services during March; (c) The rate or pricing method, if any, you regularly used during March, 1942, for services on which you did not have a flat or set price and which you priced according to an hourly rate or other method; and (d) All customary allowances, discounts and other price differentials which you customarily allowed or offered in March.

The regulation requires you to keep your list up to date and complete by adding to it descriptions, prices, rates, and pricing methods and charges for all services sold by you for the first time after March, 1942, which are not the same as or similar to, or are not priced by the same rate, or same pricing method and charges, applicable to services for which prices have already been filed. If you start a new business or add a new service not covered in your previous statement, you must prepare such a statement within ten days and file it in 20 days. Be sure that your statement for this new service contains all of the items of information listed under a, b, c, and d, in the same manner as if the new service had been supplied in March, 1942, and that in addition, you set forth the date when the service was first sold, and the manner in which the

maximum price, rate, or pricing method and charges were determined, including the name of your most closely competitive seller of the same class as yourself, if your maximum price is determined by reference to such competitor's price.

On any portion of a business which is **not at retail,** prices need not be made public if it is claimed that substantial injury would result therefrom. This claim must be made in an affidavit and attached to the statement you file with the local War Price and Rationing Board. The Office of Price Administration will keep such prices confidential unless to do so is contrary to the purpose of the regulation.

Many service shops set their prices by using an established flat-rate or similar manual. If you did last March, you can show your ceiling prices simply by: (a) Identifying clearly the manual you used in March by filing its name and edition number or date; (b) Stating your customer's hourly rate in March (your hourly labor charge) where the manual required you to use one or where you did use one; (c) Indicating all cases where it was your custom to deviate from the manual; and (d) Showing how you set prices in March in those cases where you did not use the manual.

(4) Sales Slips and Receipts. If you have usually given a duplicate of the work order or any kind of sales slip as a receipt for money paid, you must continue to give whatever kind of receipt you customarily gave.

Whether you gave a sales receipt or not, when requested, you must give a sales receipt showing your name and address, the date, the service supplied and the price charged.

It is felt that these main "guide posts" will give most service shops most of the information they need for general guidance to compliance with Maximum Price Regulation No. 165, as amended.

The regulation, however, is the document that fixes the legal duties of the persons selling services which come within its rules.

In addition, ways to find the legal ceiling prices for services which were not actually supplied but were only offered in March or for services which were neither supplied nor offered are set forth in the regulation. Copies of the regulation can be obtained from any War Price and Rationing Board.

A model statement of maximum prices prepared specifically as a guide for the electrical and gas appliance trade in meeting the filing requirements of the service regulation is attached. *Prices shown are for the purpose of illustration only,* and are *not* ceiling prices set by OPA. *Each establishment must determine its own ceiling prices.*

Typical Statement of Maximum Service Prices, Appliance Sales and Service Co. 17 Blank Street Anytown, Ohio

In all cases the prices listed below were the highest charged during March.

Prices for services regularly supplied at a fixed charge are as follows:

Domestic Irons

Element replacement	2.00
Terminal replacement	.75
Thermostat knob replacement	.70
Thermostat replacement	2.00

Percolators

Element replacement	2.25
Refinish inside	2.00
Thermostat replacement	1.40

Roasters

Element replacement (bottom)	2.25
Element replacement (side)	2.50
Pilot lamp replacement	.50
Thermostat replacement	2.00

Toasters

Element replacement	1.50

Waffle Irons

Element replacement	1.50
Grid replacement	1.75
Thermostat replacement	1.75
Terminal replacement	.75

Refrigerators

Replacing gasket up to and including 6 cu. ft.	2.00
Replacing gasket over 6 cu. ft. up to and including 8 cu. ft.	3.00
Refinishing up to and including 5 ft. refrigerator cabinet	10.00
Refinishing 6 ft. refrigerator cabinet	12.00
Refinishing 7 ft. refrigerator cabinet	13.00
Refinishing 8 ft. refrigerator cabinet	14.00

Vacuum Cleaner

Replacement of belt (to be brought in and picked up by customer)	.75

Electric Ranges

Replacing 6-inch element	7.00
Replacing 8-inch element	8.50

Radios

Installing GX123 Trutone radio in car	3.50

We do general repair and maintenance work on all types of electric and gas appliances and radios. On small appliances we make a flat charge which includes parts and labor. Articles must be brought in and called for by customer.

In March, 1942, repair prices on major gas and electric appliances and radios were based upon a fixed charge of $1.50 per hour for labor, (this charge included overhead or indirect cost and profits) with a minimum charge of $1.00 per call within City limits. Outside of City limits we charged 10 cents for each mile or fraction thereof for one way. Prices for materials, labor, and mileage were listed separately on our repair bills. We charge for parts supplied in connection with service as follows:

1. Where appliance was of a make we sold, we used manufacturer's list price in catalog in effect March, 1942.

2. Where other make appliances were serviced or regular parts were substituted we took our March cost and added 66⅔ margin (this charge represents our indirect cost and profits) to arrive at price to charge customer.

John Jones, Manager
Appliance Sales & Service Company
17 Blank Street
Anytown, Ohio.

Service Sales Promotion Letters Prove Effective

A SYSTEMATIC service sales program is keeping the Boedeker and Sons' shop, of Dallas, Texas, filled with work. It is keeping customers' appliances functioning and is maintaining contact with owners so that after the war when appliances once again become plentiful, Boedeker's will be the first dealer thought of by many Dallas householders.

Their system is quite simple. It merely involves keeping a record of several hundred owners of refrigerators and other major appliances in the Greater Dallas area, and mailing them occasional letters or calling them by telephone. One letter, which has brought particularly good results from the owners of the older, open type machines, is reproduced here.

Telephone calls for refrigerator service are made by Burtis Holt, supervisor for refrigerators and ranges. His once large force of salesmen has been cut to himself alone; and in the washing machine division, H. R. Livingston, supervisor, is the only employee retained—with the exception of one floor salesman who works on all major appliances.

Both Holt and Livingston use the telephone systematically. They call the store's regular customers and frequently use the canvass method—from the "Red Book," official consumer rating book on Dallas people issued by the local retail credit organization. A group of names of people of good standing is selected and these people are contacted by telephone.

There is no set approach to the prospect. Holt may tell her they are making a survey; or as part of the government's recommended program to conserve all major appliances, they are calling to remind her that since it is not possible now to procure a new refrigerator, it is practical to have their present box checked and fixed, which may avoid a breakdown at a time when the refrigerator is needed most.

Classified advertisements in the daily newspapers are also used to good advantage. These are run daily and usually are on service, though they are switched to used equipment when the store has a few trade-ins, or new appliances available.

When someone calls in, says her refrigerator isn't working and wants an estimate of the cost to

(*Continued from page 50*)

Mrs. John Doe
111 First Street
Dallas, Texas

Dear Mrs. Doe:

Production of new refrigerators was stopped by Government order on February 14th, so we are sure you will want to take extra good care of the refrigerator that you have.

To help you keep your refrigerator in the best of condition, we will call at your home and inspect your refrigerator to help insure its continued good operation for the duration of the war.

Here are some of the inspections we make:

1. Oil if necessary
2. Check belt
3. Check compressor
4. Clean condenser
5. Check switch adjustment
6. Check door seal
7. Check hinges and latches
8. Check voltage
9. Check motor cord and terminal
10. Check gas supply.

Charge for this service is nominal, only two dollars for complete operation.

Our factory trained mechanic will be in your neighborhood soon. If you wish to take advantage of this service, won't you call us soon so that we can add your name to our schedule?

Yours very truly,

BH/mac

Appliance Department.

PRACTICAL HELPS for the TRADE

Contractor - Dealer - Motor Shop

Charging Refrigeration Units on "Low Side"

J. L. Tanner, owner of the Appliance Service Company, Miami, Fla., has what appears to be a clever method for recharging refrigeration units.

Removing the unit from the box, Tanner places it on a portable stand. To the short length of tubing, extending from the "low side," he then brazes a longer length of copper tubing. For this purpose he uses "1 oz." silver solder. Eight to ten inches of solder-stick is sufficient for the operation.

Connecting the copper tubing to the recharge cylinder with a flare-nut and coupling, Tanner starts up the unit by plugging in an extension cord hooked up to a lighting circuit. Vacuum, of course, draws the refrigerant into the unit.

The construction of the portable stand, described below, makes possible the enclosure of the freezing-chamber. Testing the temperature of the latter with a thermometer indicates when the correct amount of refrigerant has been taken in.

Tanner claims that this method is the most positive way he knows to determine the right amount of refrigerant to be used for recharge.

The portable stand makes easier any work he has to do in connection with the repair or recharge of a refrigeration unit.

The "portable" feature of the stand is incorporated in a movable platform, often called a "dolly." Mounted on two-inch, swiveled iron castors at each of its four corners, the framework of the platform was constructed of 2-inch by 4-inch stock, and floored over with 1-inch scrap lumber. In fact, the device was built entirely from scrap material.

Rectangular in shape, the stand portion of the "gadget" is 18 inches wide, 25 inches long and 20 inches high. When mounted on the movable platform, the upper edge of the stand, which is really a cabinet, open at the top, is about 30 inches above the floor. Two-by-four lumber was used for the frame of the cabinet, and 1-inch material for sides. A door at the front provides access to the freeze chamber of the refrigeration unit under-going repair.

According to Tanner, this movable stand is a "back saver."

Portable stand used by J. L. Tanner, Miami, Fla., facilitates recharging and other work on refrigeration units.

Clever Canvass Plan Builds Repair Volume

Electrical appliance dealers going into the repair field for the war and wondering how to obtain a profitable volume of small appliances for repairing can take a tip from Oak Electric Company, of New Orleans, La., and canvass from house to house for them.

Oak Electric Company, a small wiring and wiring repair firm until the war began, now handles repair service on fans, irons, toasters, waffle irons, mixers, and all small table appliances. The shop also has gone into the radio field, and will recondition a certain amount of electric refrigerators, using "slack time" when the shop isn't busy to send a man outside for the work. Three mechanics, including one young man being trained for the repair job, are now kept busy eight hours a day profitably repairing scores of small appliances which come into the stores as a result of a clever house-to-house canvassing idea.

When Oak Electric converted over from house wiring and appliance sales, the management wasn't certain how large a market existed. To find out, a "salesman" was appointed (one of the shop men) to go out into the immediate neighborhood, knock on doors, and ask the lady of the house whether she had an iron, vacuum cleaner, toaster, fan, etc., out of service.

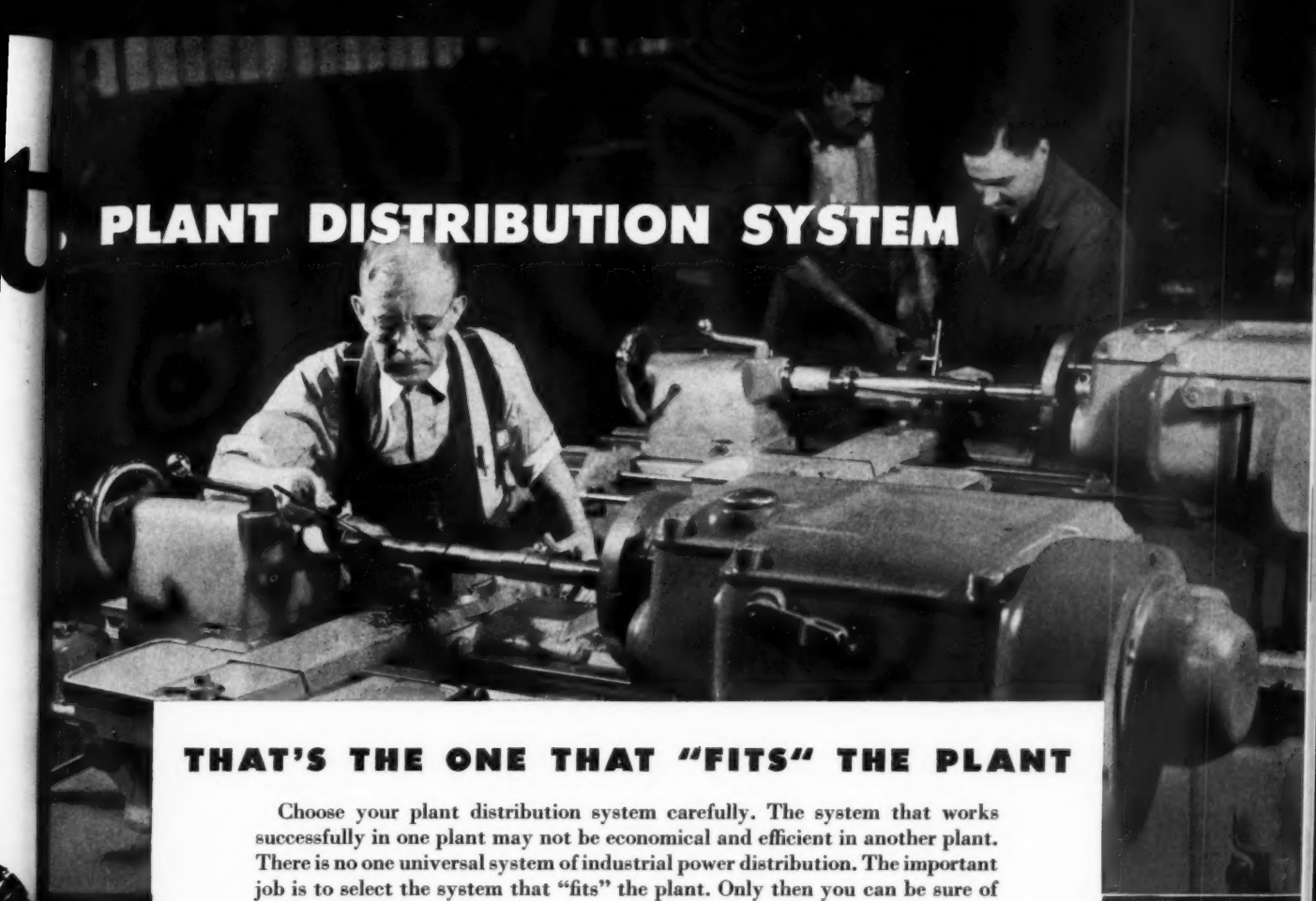
Most women proved willing to tell if they did; but were usually too busy to hunt it up for an examination. Consequently, it looked as though it would be difficult to induce the appliance owner to bring them in. To get around this, Oak Electric Company developed a clever idea — an offer to *buy* the appliance involved.

Under this plan, salesmen visit three blocks of houses each day, and when the housewife comes to the door, again ask whether she has any out-of-service appliances. If this is so, the salesman asks to see it at once, with an offer to pay her for it. This usually induces the housewife to dig into the closet or basement for the appliance, and bring it to the Oak Electric salesman. The latter inspects the appliance gravely, and then makes an offer for it based on its probable resale value in the store. Here the real value of the plan comes in — for the housewife is invariably convinced by this call that the appliance must be valuable, and that perhaps she had better hang on to it herself! If she refuses to sell it (and most do) she is asked to allow Oak

(Continued on page 34)

THERE IS ONLY **one best**

Westinghouse



PLANT DISTRIBUTION SYSTEM

THAT'S THE ONE THAT "FITS" THE PLANT

Choose your plant distribution system carefully. The system that works successfully in one plant may not be economical and efficient in another plant. There is no one universal system of industrial power distribution. The important job is to select the system that "fits" the plant. Only then you can be sure of maximum results.

Westinghouse can supply complete equipment for all types of distribution systems, including the new Plant Network System now installed in approximately 40 large war factories.

All systems recommended by Westinghouse are designed for use with standard distribution equipment. Regardless of which system you select, there will be no need to lose time in the construction of special apparatus.

To help you save time in selecting the best system for your use, Westinghouse has prepared a special booklet that briefly describes the advantages and applications of a selected group of distribution systems. Diagrams of each system are included. For your copy, just fill in and mail the coupon.

If you want faster action or more complete details, just phone our local office. One of our engineers will be glad to call and discuss your problem.

Westinghouse Electric & Manufacturing Company
East Pittsburgh, Pa.

FREE QUICK FACTS ABOUT PLANT DISTRIBUTION SYSTEMS

Westinghouse Elec. & Mfg. Co.,
East Pittsburgh, Pa.

Please send book B-3152 giving quick facts on Westinghouse Distribution Systems.

*Name*_____ *Title*_____

*Company*_____

*Address*_____

*City*_____ *State*_____

J-94509

Plant Distribution Systems

Electric to repair it at once — and 90% of such women consent.

If the customer called on wants to sell the appliance, whatever it is, the store can make a reasonable profit from it after reconditioning and cleaning it up. If she gets the idea that the appliance may be worth a lot more than she had suspected, she invariably will want to put it back in operating condition. Thus, in making a dozen calls per day, the store is getting twice as many appliances to repair as could be expected from advertising of any kind, and they are getting a small but profitable volume on reconditioned fans, vacuum cleaners, mixers, etc., which customers are willing to sell.

Emergency Repairs Require Ingenuity

Appliance service men must use more ingenuity as parts become scarce and the need for service work increases. Here are some suggestions that may prove helpful.

Most of the motors I have worked on are repulsion-induction, brush-throwing, "end-commutator" type. To clean the inside of the bore of the "end commutator" I use a short piece of radiator hose, the outside diameter of which is about ⅛-inch less than the inside diameter of the "bore." Around the hose I wrap one turn or less of coarse sandpaper and slip the hose over the motor shaft into the bore. A good job of cleaning or even cutting can be done quickly, simply by squeezing the hose and using it as a handle to apply the sandpaper.

I don't recommend this one for general practice, but it did get me out of a tight spot. I rushed a small motor to the shop and pressed in a new bearing, reamed it to fit the shaft and then discovered it to be as sloppy as the old bearing. The motor shaft was of the type that is one size from the part that carries the pulley — right on through to the bearing. After a little study, I drove out the new bearing I had just put in, slipped another new bearing over the shaft clear up against the oil slinger. Then used the motor shaft as an arbor with which to force the bearing into the end bell.

Of course, the end bell compressed the bearing a few thousandths and I had a nice fitting bearing even though the shaft at the point of bearing was undersize. Otherwise a rewind and new shaft or a built-up shaft would have been required.

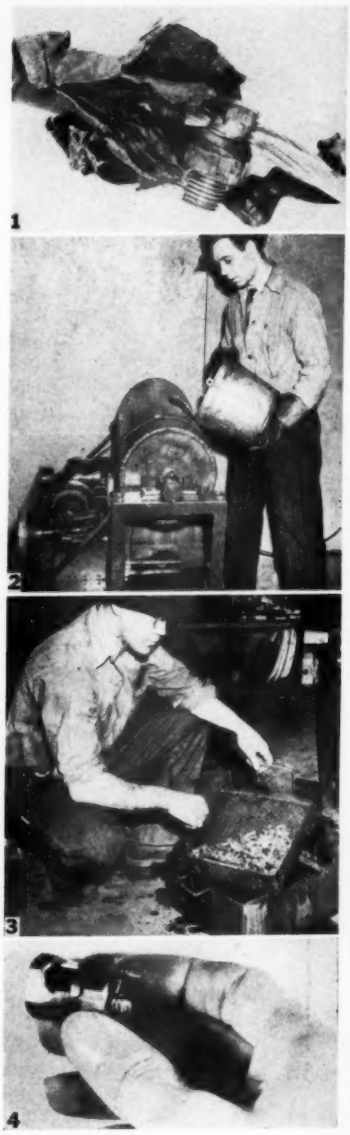
Upon telling a friend about it, he said, "Yes, but how would you go about getting the shaft out after the bearing was pressed into the end bell, in case it was necessary?"

But I was one jump ahead of him. "Simply take two or more old bearings — badly worn, of course," I said, "and slip them on the shaft. Use them to push the new one out of the end bell along with the shaft all at the same time."

Turning Worn Bearings

Another emergency repair which I would not recommend for general practice has to do with worn bearings. Most of the motors I work on are of the horizontal vee-belt drive type. Quite often they are on automatic belt tightening bases. I noticed that the bearing was always worn on the side toward the load. Never in the bottom or on the side away from the load. So when I found myself out of bearings for a motor that had to go back into service in a hurry, I simply turned the worn bearing end for end and pressed it back into the end bell. Of course, I would rather have installed a new bearing, but lacking that I would rather save meat and other perishables by getting the refrigerator back in service. And I have found that such "turned around" bearings will give years of service.

When overhauling an electric motor I pay particular attention to the throwout weights, rods, collars, and so forth. If any part of this mechanism is not clean and lightly oiled, it's inviting rust and trouble. The throwout must work easily. I also get a superior finish on the face of the commutator by using a stone applied with a continuous rotary or circular motion similar to the motion used in lapping. Brushes last longer and give better commutation. I am particularly careful about oil wicks. I want them to go all the way to the bottom of the oil well. I also want them to be packed tight over the opening in the bearing, so that there will be no chance of their getting out of contact with the shaft.—*A. R. Pool.*



Salvaging Small Electrical Parts

Imagination and ingenuity are integral parts of salvage work. As an example, here is a machine built from scrap materials to speed up and make more efficient the salvage of other items.

(1) This is how connectors arrive, corroded and dirty.

(2) A bucketful of copper solderless connectors, corroded from use and insulating tape, is poured into drum containing a cleaning solution of kerosene and buckshot. With the cover bolted in place, the drum is rotated electrically. Many bolts and nuts are also cleaned and salvaged in this manner.

(3) Cleaning solution and buckshot are separated from the items cleaned with the aid of this sieve tray.

(4) Connectors are clean and shiny as new after treatment.

WHERE *Power* LOAFS PRODUCTION LAGS

Throughout American Industry the New BullDog Vacu-Break Safety Switch is Helping to Keep Power on the Job . . . Speed Production—Reduce Maintenance Cost

The finest electrical distribution system in the world is no better than its switches. The right type of safety switches can keep power on the job every minute, free from current losses caused by lost motion in switch operation, by pitted or burned out contacts, by loose fitting contact devices.

The new BullDog Vacu-Break Safety Switch is that right type of switch, designed to meet today's emergency needs, to carry the loads of round-the-clock production schedules, to stand the wear and tear of *constant* operation and lack of adequate maintenance time.

Industry has been quick to see the advantages of the New Vacu-Break Switch—hundreds of the country's greatest war plants are specifying it as standard equipment, sure of its ability to "stand the gaff."

Cut-away view of new formed Bakelite arcing chamber shows how snugly the clamping pressure contacts fit therein.

PLUS FEATURES OF THE FRONT OPERATED VACU-BREAK SAFETY SWITCH

1. ***"Clampmatic"* SWITCH CONTACTS:** Provide in a very simple way, "Clamp type pressure" when switch contacts are closed, and at the same time, the switch operates more easily and quickly than switches having only ordinary pressure contacts.
2. **QUICK ACTION MECHANISM:** Assures positive "ON" and "OFF" operation. Provides front operation and enhances modern streamlined appearance.
3. **FORMED BAKELITE "ARCING CHAMBERS":** Confine arcs — prevent burning and pitting of contacts. Rugged current-carrying parts reduce maintenance and replacements.
4. **SIMPLIFIED OPERATING MECHANISM:** Greatly reduces parts necessary for smooth, positive and firm operation. No "lost motion" in operating mechanism.
5. **WIRING ROOM—AMPLE yet COMPACT:** The neat trim condition of switch interior is designed to provide maximum wiring space without sacrificing overall compactness.

Available in Master (Type A) and Standard (Type C) 30 Amp. to 200 Amp. inclusive

BUY WAR BONDS AND STAMPS

Rocker type handles positioned inside lines of cabinets enhance their fine streamlined appearance.

BULLDOG
ELECTRIC PRODUCTS CO.
DETROIT, MICHIGAN

BullDog Electric Products of Canada, Ltd., Toronto, Ontario

Field Engineering Offices in All Principal Cities

MANUFACTURERS ALSO OF SAFTOFUSE PANELBOARDS, CIRCUIT MASTER BREAKERS, SWITCHBOARDS, BUS DUCT SYSTEMS—FOR LIGHT AND POWER

Appliance Owners "Swap" Through Knoxville Agency

A novel feature of the "Keep 'Em Working" appliance-repair program which Knoxville Electric Power & Water Board is sponsoring in cooperation with fifteen appliance dealers, a "swap agency" through which consumers can exchange used appliances of one kind for another to everybody's satisfaction.

The idea of the "swap exchange," according to the Knoxville utility, was born when it was discovered that many homeowners refused to fix up old appliances stored around the house on the basis that they had no use for them. When asked whether they would trade them for some other kind, most homeowners replied affirmatively. Consequently, ten former electric appliance salesmen of the utility, who are now canvassing homes for repair work, are making a list of all major and small appliances which the owners do not care to operate. In a central office, they are compared with requests from other owners. All such requests for trades are filed alphabetically. Thus, when an un-used roaster is available, it can be traded for an electric hot plate, or a refrigerator for an electric range, etc.

Customers are allowed to work out their own agreement, of course, the utility serving merely as a clearing-house. The result is that all usable appliances are "kept working."

Ten Suggestions for Scrap Campaigns

(1) Head up the campaign by appointing an able executive of the company, armed with authority to act.

(2) Use posters, illustrations, pay-envelope stuffers, and all other publicity means to enlist all employees in scrap campaign.

(3) Comb plant and yards for dormant scrap and unusable and abandoned equipment.

(4) Survey all plant equipment, particularly idle, standing or discarded machines.

(5) Classify and segregate scrap and supervise its handling.

(6) Make each foreman responsible for preventing spoilage and waste in his department.

(7) Report promptly equipment which is obsolete. If equipment has not been used in three months, and it can't be proved that it will be used in the next three, turn it over where it can be used . . . or scrap it.

(8) Salvage usable parts from equipment marked for scrapping.

(9) Speed return of scrap to mills and refineries through existing channels. Report regularly on collections of scrap to the Industrial Salvage Committee set up by the War Production Board in your community.

(10) Enforce monthly re-checks in every department to find scrap material previously overlooked.

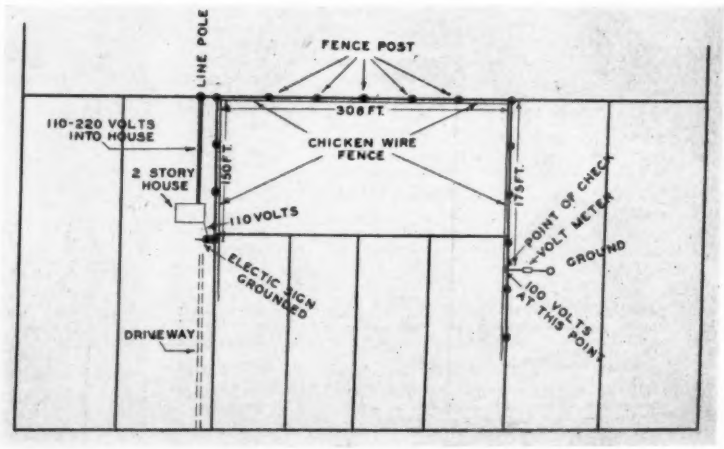
Measuring Controller Contact Resistance

Referring to the article entitled "Maintaining Electrical Controls," published in the July, 1942, issue of ELECTRICAL SOUTH, a reader has asked for more information on the selection of a millivoltmeter for measuring the voltage drop across contactors.

In answer to this inquiry, the author of the article, E. H. Alexander, suggests that the proper millivoltmeter to be used for reading the voltage drop across high resistance joints or contact points of a magnetic starter is a thermocouple type voltmeter available as a medium sized portable instrument.

"This instrument is particularly adapted for use on applications where a low-voltage, high resistance a-c voltmeter is required," writes Mr. Alexander, "but it is important to note that the same instrument is applicable on both a-c and d-c circuits, thus making it possible to shoot trouble on a high resistance d-c joint as well as a high resistance a-c joint.

"One instrument available in this type has four separate scales which can be used, the lowest one reading 0.5 volts full scale, or 500 millivolts full scale. We feel that the 500 millivolt full scale will cover probably the worst condition of contactor tip trouble, but it should be remembered that a tip which is entirely open circuited and incapable of carrying any cur-



Nasty Shock from Sign Grounded to Metal Fence

"The accompanying diagram shows how dangerous it is to have an electrical sign attached to, or come in contact with a metal fence, when it develops a ground," reports I. L. Bond, electrical inspector for Orlando, Florida. "The pipe driven in the ground to support the sign had a goose neck attached with socket and metal shade for the light.

"The fence wire was wrapped around this pipe driven in the ground. It was discovered to be in trouble when a lady, working in her flower bed along this fence at point of diagram shown on volt meter to the ground, came in contact with the metal fence and received a terrible shock. Not knowing what it was, she kept working. Again, she touched the metal fence and this time it knocked her over. Then she began to investigate and called my office, and together with the power company, we made the investigation and found conditions as shown in the diagram."

rent will give a reading equal to the full open circuit voltage across the tips, so that this caution should always be borne in mind so as not to damage a sensitive instrument."

Saving Critical Materials In Distribution Systems

Tons of critical materials, particularly copper, can be saved by following these ten principles in installing war-plant power distribution systems:

1. Calculate as accurately as possible what the *actual* load will be and design the system to carry only that load — not on the basis of connected load.

2. Keep to the practicable minimum the distance over which the electric power is to be carried.

3. Transmit power at the highest practicable voltages and bring the high-voltage distribution as close to the load as possible.

4. Correct for low power factor at a point as close to the reactive load as possible.

5. Use compact, standard equipments. This not only saves copper, time, and money but also makes possible quick replacement in case of trouble.

6. Arrange layouts to limit circuit-breaker interrupting requirements to the optimum values, thus saving copper in busses and breakers.

7. Use three-phase power transformers wherever feasible.

8. Use forced cooling on power transformers wherever practical.

9. Select cables with a type of insulation which will permit maximum load per unit of copper.

10. Limit the number of cables per duct bank to the minimum to avoid loss of current-carrying capacity.

Accurate Folding of Slot Insulation Paper

The best method I have found for measuring and cutting insulating paper to fit in the slots of a motor being rewound is as follows: with a pair of dividers take the measurements, one at a time, of the sides and bottom of the slot and transfer these measurements to the paper. Then bend the paper accordingly on a paper bender. This eliminates guesswork as the paper then fits the slot perfectly.—*E. T. Cox.*

Architects and Engineers Data Book Available

A new 178-page book, designed particularly to give architects and engineers application, specification, and price estimating information, is announced by the Westinghouse Electric and Manufacturing Company.

The book covers more than 100 different types of electrical equipment including motors of all sizes, control, switchgear, transformers, protective devices, circuit breakers, no-fuse load centers, panelboards, household equipment, and mechanical equipment such as stokers, turbines, and elevators.

From one to three pages is devoted to each unit or group of units and under each is listed application information; outstanding design features; a description of the unit, plus illustrations; a chart to assist in the selection of the proper unit for the job; and typical specifications.

The book is divided into two parts, the equipment section which includes the information as outlined above, and the engineering data section.

The engineering data section includes such information as suggested adequate standards for residence wiring, oil and air circuit breaker application data, transformer and motor application data, National Electrical Code Application Data, how to determine feeder sizes, voltage drop curves, commonly used symbols for one line electrical diagrams and information on estimating prices.

A copy of "The Architect's and Engineer's Data Book," B-2161-B, may be secured from department 7-N-20, Westinghouse Electric and Manufacturing Company, East Pittsburgh, Pa.

New Electrical Books

Fundamentals of Electric Waves

By Hugh Hildreth Skilling, Ph. D., Professor of Electrical Engineering, Stanford University. Published by John Wiley & Sons, 440 Fourth Ave., New York, N. Y. 186 pages, illustrated. Price, $2.75.

Recognizing the importance of electro-magnetic wave theory in the training of certain personnel of the Army and Navy, as well as to many other people, the author presents in this book an introductory course on electric waves in a way that has proved to be understandable to students. The book has been arranged for those who do not necessarily have any previous knowledge of electro-magnetic theory, and all that is required is general college physics and mathematics through calculus. Vector analysis is introduced for use in the book but it is not expected that the reader should have any earlier acquaintance with it.

The opening chapters of the book concern themselves with electro-statics, the use of vector analysis, and similar matters. Following these fundamental chapters are discussions of radiation and wave propagation, antennas, transmission lines, and wave guides. Problems are given with each chapter, and they are an integral part of the book. Most of them supplement some idea that is left without complete discussion in the text. They are arranged in the same order as the text material with which they are to be used.

A particularly helpful feature of the book is the reproducing on the inside cover of the formulas and fundamental equations most frequently encountered in the study of this subject, as well as a table showing a comparison of the various units encountered in electric wave theory.

American Electricians' Handbook—Fifth Edition

By Terrell Croft, consulting engineer; revised by Clifford C. Carr, head of E. E. Department, Pratt Institute. Published by McGraw-Hill Book Co., Inc., 330 West 42nd St., New York, N. Y. 1634 pages, illustrated. Price, $5.00.

The well-known Croft Handbook for Electricians has been completely revised and enlarged. Long considered as a standard reference for anyone concerned with electrical equipment, the new book now contains 1600 pages of practical descriptions, information, and data to aid electrical men in intelligently selecting, installing, and operating electrical apparatus and materials. Accurate data based on correct engineering principles are presented in simple language so that the book is of equal value to the man of little technical training as well as to the technically trained engineer.

In this edition, new sections and more pages have been added, parts of the book completely rewritten, and everything necessary changed to make the book representative of best modern practice and a practical reference and study guide to electrical fundamentals, materials, equipment, and their application.

As in the case of previous editions, an outstanding feature of the latest edition of the American Electrician's Handbook is the large number of diagrams and illustrations which greatly facilitate a study of the text itself.

(Order direct from publisher)

NEWS of the INDUSTRY
National and Southern

Washer and Ironer Repair Week Sponsored by G.E.

To help electrical appliance dealers learn more about the repair and maintenance of General Electric washers and ironers, the General Electric Company sponsored a "national home laundry training program" which began recently.

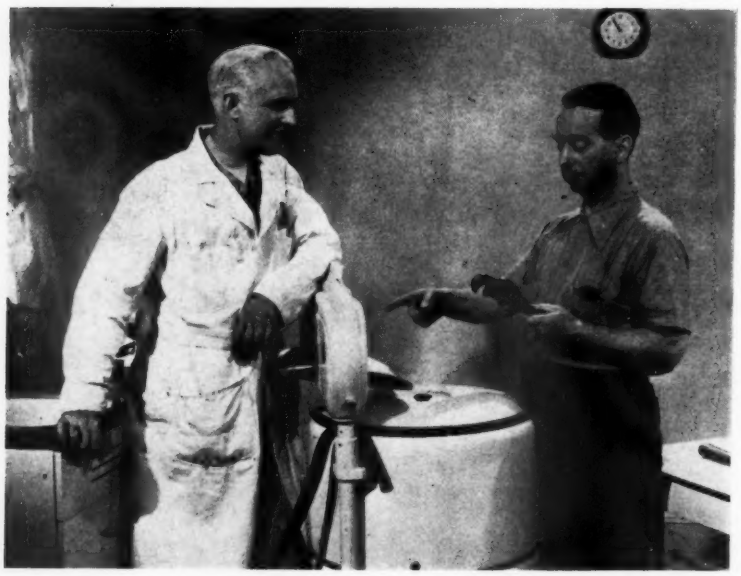
General Electric appliance dealers throughout the country, in the next few weeks, will attend concentrated training schools which will provide special courses of instruction on the repair and maintenance of home laundry equipment.

General Electric district product service supervisors and district product service managers will participate in the local training programs which will feature a 20-minute sound slide film entitled "Service Mechanisms and Wringers." While dealers and their staffs who attend the training schools will be instructed in the latest approved methods of washer conservation and repair, particular emphasis will be placed on the idea of making adjustments and reconditioning faulty equipment whenever possible in order to conserve brand new replacement parts for cases where new parts are absolutely necessary. This policy is being followed in cooperation with WPB's material conservation effort, so that the supply of new replacement parts will last as long as possible.

Another feature of the training program will be a moving picture entitled "Into the Wringer and Out with J. Smedley Sprout" which shows the right way to handle washers and demonstrates the folly of amateur tinkering by the average husband on precious appliances which cannot be replaced.

Dealers attending the meetings will be brought up to date on government priority orders, on the parts and stock supply, and on the approved methods in use and care.

Dealers who participate in the training schools will receive emblems identifying their stores.



In this scene from the movie "Into the Wringer and Out with J. Smedley Sprout," one of the program features in a series of meetings held for G.E. appliance dealers, J. Smedley takes his trusty wrench in hand and demonstrates just how ignorant an amateur tinkerer can be when something goes wrong with a washer. The meetings are part of General Electric's washer and ironer repair and maintenance training program.

I.E.S. Selects New Officers for 1942-43

Richard B. Brown, Jr., illuminating engineer, Boston Edison Company, Boston, Massachusetts, has been elected president of the Illuminating Engineering Society, and will assume his new office on October 1, according to a recent announcement by the Society.

Richard B. Brown, Jr.

Other national officers recently elected are: vice-president until September 30, 1944—S. B. Williams, Editor "Electrical World," general secretary—Oscar P. Cleaver, Westinghouse Lamp Division, Bloomfield, N. J.; treasurer—A. F. Wakefield, F. W. Wakefield Brass Co., Vermilion, Ohio; directors until September 30, 1945—A. A. Brainerd, Philadelphia Electric Company, and R. W. Staud, Benjamin Electric Mfg. Co., Des Plaines, Ill.

In addition, the following regional vice-presidents were elected for two-year terms ending September 30, 1944—Carl T. Bremicker, Northern States Power Company, Minneapolis, Minnesota, representing the Mid-Western Region; G. R. Baumgartner, General Electric Company, Nela Park, Cleveland, Ohio, representing the Great Lakes Region; Fred J. Wellhouse, Westinghouse Electric and Mfg. Co., San Francisco, representing the Pacific Coast Region; and Clarence C. Keller, Holophane Company, Inc., New York, N. Y., representing the Northeastern Region.

To fill the offices made vacant by the resignations of Carl T. Bremick-

HOTPOINT WARTIME ADVERTISING Does *Five* Jobs!

1. Helps Uncle Sam sell War Bonds. **2.** Provides incentive to save for a Hotpoint Electric Kitchen after the war. **3.** Keeps the Hotpoint name before the public. **4.** Builds interest in the Electric Kitchen for the home of the future. **5.** Tells people that low-cost homes can afford Hotpoint Electric Kitchens.

Sells War Bonds *Today* . . . Electric Kitchens *Tomorrow*

People earmark the money they save for some future purchase. Hotpoint advertising in national magazines encourages them to buy more War Bonds and keep them to finance a Hotpoint Electric Kitchen after the war.

National Advertising reaches millions of interested families

★ ★ ★

Hotpoint advertisements showing low-cost kitchens in full colors appear in these national magazines

PUBLICATION	ON SALE	ISSUE
Electricity on the Farm	September 1	September
Collier's	September 11	September 19
House Beautiful	September 18	October
Better Homes and Gardens	September 25	October
American Home	September 25	October
Electricity on the Farm	October 1	October
House Beautiful Maintenance and Building Manual	October	Fall & Winter
Life	October 9	October 12
Collier's	October 9	October 17
House Beautiful	October 19	November
American Home	October 23	November
Electricity on the Farm	November 1	November
House Beautiful Guide for the Bride	November	Fall & Winter
Life	November 6	November 9
Saturday Evening Post	November 11	November 14
Bride's Magazine	November 15	November 15
Collier's	November 20	November 28
Better Homes and Gardens	November 25	December
Life	December 4	December 7
Saturday Evening Post	December 9	December 12

A PLAN THAT YOU CAN USE LOCALLY!

Washington Likes This Plan

OFFICIALS of the Treasury Department have stated that they will appreciate the cooperation of retailers in supporting this program locally.

How You Can Help. Hotpoint's Plan Book "Maybe Tomorrow" explains every step and shows mailing pieces, newspaper advertisements and the novel Home Planning File. Ask your Hotpoint distributor for details. Edison General Electric Appliance Co., Inc., 5614 West Taylor Street, Chicago, Illinois.

Hotpoint
ELECTRIC
KITCHENS

★ ★ ★

er and W. J. Amoss, I.E.S. regional vice-presidents of the Midwestern and Southern Regions, respectively, before leaving for active duty with the armed services, the Council of the Illuminating Engineering Society has appointed I. L. Illing to serve as vice-president of the Midwestern Region and John M. Guillory to serve as vice-president of the Southern Region.

Utility Promotes Salvage With Sound Slide Film

A sound slide film entitled "Our Part in America's War on Waste," has been produced by the New Orleans Public Service, Inc., of New Orleans, as part of a waste prevention and conservation program. The film has been shown to all employees, members of the company meeting in small groups under the direction of a conference leader to view the film and to discuss its application of their particular line of work.

Supplementing the film, a booklet containing the same pictures and script was distributed to all members of the company after the film had been shown, in order to get the same story across in both visual and printed form. In addition to the pictures and script from the film, the end of the booklet lists some outstanding ways in which employees can help eliminate waste and conserve materials.

The purpose of the film is twofold, according to Dorothea Schlesinger, advertising department, (1) to let employees know what the company is doing in salvage and reclamation operations, and (2) to impress on every employee the necessity of his conserving existing materials and equipment and doing the best he can with the limited amount of additional supplies and materials available. The point is emphasized that although an essential industry, the company is restricted in the amount of new equipment it can get. Since the services the company renders are essential to the war production program, they must be maintained and the film thus places the issue squarely before employees that it is their patriotic duty to conserve, to prevent waste, and to salvage and reclaim materials and equipment for further use wherever possible.

OPA Publishes Manual on Service Price Ceilings

The Office of Price Administration has begun quantity distribution of Manual No. 2, explaining how the service trades price regulation (Maximum Price Regulation No. 165 as Amended—Services) applies to the more than 600,000 service establishments throughout the country.

Similar in scope to Bulletin No. 2, which explained to retailers the operation of the General Maximum Price Regulation, Manual No. 2 is intended to help the many service trades affected to understand the provisions of the service trades price regulation and to check their ceiling prices under its terms.

Services whose maximum prices are established by the regulation are listed in the manual. The 61 classes of service businesses regulated embrace among others the maintenance, rental and repair of many commodities, including electrical appliances, furniture, and equipment for offices or stores. Commission selling, custom processing of many commodities, and transportation brokerage are other services covered.

The manual explains how to arrive at maximum prices under the service trades price regulation, and various other requirements which service establishments must meet. Copies of Manual No. 2 are being made available through all Regional and State OPA offices and War Price and Rationing Boards, as well as through various trade associations.

Kelvinator Announces Advertising Program

Kelvinator retailers have received renewed practical assurance of their company's full support with the announcement by Nash-Kelvinator, now fully engaged in war work that calls for a yearly output three to four times as great as its normal domestic business, that it will launch an extensive advertising drive that is expected to be on a sustained basis.

A comprehensive number of national magazines, major-market newspapers, trade publications, and business papers will be used, according to Frank R. Pierce, vice-president, who made the announcement. The objective, he said, was full support of the war effort, and the protection of the company's name and its retailers.

In trade paper copy, a statement over Pierce's signature, declares that Nash-Kelvinator's new consumer advertising has been designed to accomplish three things:

"To report to our present and future owners on the vital part Nash-Kelvinator is playing in America's war effort — the honor of building fleets of great cargo-carrying flying boats, engines for the highest-flying fighting ships in the world, and thousands of propellers for the fighters of the United Nations."

"To promise that the Kelvinators of the peacetime to come will be finer, better than before because of the amazing technological developments called for in Kelvinator war work.

"To maintain and to increase, for the future profit of Kelvinator retailers, the brand preference for Kelvinator."

Pierce expresses confidence in the advertising that "when the name of Kelvinator comes back from war, it will have a new and deeper significance to the American people — and will be of even greater value to the retailer franchised under the Kelvinator Selective Dealer Policy." New prospects, he said, would be the greatest in history.

In an impressive ceremony on the company grounds, Greenlee Bros. & Co., of which Greenlee Tool Co. is a division, was presented the Army-Navy "E" Flag. Presentation of the flag to George C. Purdy, president of the company, was made by Lieutenant Colonel Edward H. Bowman, chief of Chicago Procurement District Lieutenant Commander R. J. Twyman spoke for the Navy and presented employee representatives with "E" pins. Later, all employees were given these pins, which identify each wearer as a member of an organization that has been cited for high achievement in the production of war equipment.

Dramatic full-page, four-color Nash-Kelvinator copy will break in sixteen leading national magazines beginning in September, it was made known by H. G. Little, director of advertising and public relations. Also planned for early insertion are black and white ads in newspapers in selected markets and plant cities, he revealed.

Hotpoint Staff Will Promote Bond Sales

With no merchandise to sell, Hotpoint last month brought its ten district managers to Chicago, showed them how its manufacturing facilities are devoted 100 per cent to war production, and started them back to their respective headquarter cities with a plan to sell War Bonds with which to finance "Bombs Today—Bungalows Tomorrow."

The Hotpoint field organization, under the guidance of Board Chairman Geo. A. Hughes, President A. D. Byler, Vice-President R. W. Turnbull, General Sales Manager G. H. Smith, and Advertising Manager W. A. Grove, were taken for an extended tour through the Hotpoint company's Chicago plants where they were given a first hand glimpse of an electrical organization converted from making home conveniences to the manufacture of "Adversities for Adolf," "Handicaps for Hirohito" and "Bundles for Benito."

The Hotpoint fall advertising program, which urges the purchase of War Bonds now with which to build homes tomorrow, and features a novel Home Planning File to encourage and aid home planning now for post-war building, is, according to Hotpoint General Sales Manager Smith, gaining the enthusiastic cooperation of dealers and utilities from coast to coast.

An interesting sidelight is the interest shown by retailers and contractors in all lines associated with home-building who recognize the Hotpoint plan and the Planning File as a means of making the "duration" more endurable and the future fraught with greater promise.

A novel adjunct to Hotpoint's War Bond selling program is an attractively designed "Home Planning File" for presentation to actual prospective home builders. Representing a green tile roofed red brick house, the substantial cabinet of heavy binder board contains letter files for clippings, illustrations, sketches and notes for the home planner. Here may be kept in orderly arrangement all data that may be culled from newspapers, magazines, and other sources. In addition, under the heading, "Saving Today to Build Tomorrow" is a file for keeping War Stamp Books and Bonds or a record of bonds purchased — the cover containing a ruled record for listing bonds bought, by numbers, amount, date bought, date of maturity, maturity value, and purpose for which it is ear-marked. The Home Planning file is available now to dealers and utilities through Hotpoint's regular distribution channels.

Premier Advertising Plan To Promote Service

At a meeting in Cleveland of Premier men, a co-operative newspaper advertising plan was outlined to the division managers of Premier Division, Electric Vacuum Cleaner Company, Inc.—a plan designed to help dealers promote Certified-Guaranteed Service.

R. B. Wilson, Premier's executive vice-president and sales manager, in announcing the new plan, said: "I believe that this is the first time that co-operative advertising has been made available to promote vacuum cleaner service. It is logical at this time, however, since 'revival' of vacuum cleaners is going to mean 'survival' for many a dealer. This new co-operative advertising program appears to be most effective for the rapid development of service volume for dealers."

With the manufacture of new electrical equipment out of the picture for the duration, service, once regarded as the stepchild of the appliance business, is finally coming into its own. To meet this new situation Premier, months ago, devised and organized Certified-Guaranteed Service and advertised it nationally as a specific, guaranteed "brand" of service backed up by the manufacturer and the Good Housekeeping Guaranty Seal. This service, which has developed wide acceptance, is already the backbone of many dealers' vacuum cleaner repair and reconditioning business, and is also an effective "leader" for service business on all types of appliances.

Novel direct-mail pieces, attention-getting display cards, identifying authorized dealer emblems, circulars, business-building newspaper mats—in fact, everything needed to promote appliance service is included in Premier's program. It was also announced to Division Managers that a Premier Service Training Plan has been organized for dealers and their service men.

Premier Division, Electric Vacuum Cleaner Co., is currently featuring a new counter display package of replacement parts designed for over-the-counter sales. Parts included are those which require no special tools to install. The package attractively displays a bag and an assortment of brushes, belts, casters, wheels and handle-grips as well as a wide variety of smaller replacement parts.

Wholesalers Cancel Winter Convention

The fall convention of the National Electric Wholesalers Association, originally scheduled for October, 1942, has been cancelled, according to announcement by Alfred Byers, secretary of the association.

Arrangements have been made however, to hold a meeting of the Executive Committee of the Association at the Hotel Pennsylvania, New York, N. Y., October 28 and 29, 1942.

Carolina Electrical Workers Organized

Electrical workers from all parts of North Carolina met at Charlotte, N. C., September 21 and organized the North Carolina State Electrical Workers Association, an American Federation of Labor affiliate.

C. H. Gudger, of Asheville, was elected president of the organization, R. B. Webb, of Wilmington, was named vice-president; W. H. Yandle, of Charlotte, was made secretary and treasurer; W. H. Gay, of Plymouth, was named sergeant-at-arms, and J. A. Scoggins, of Charlotte, was named head of the legislative committee.

A constitution and by-laws were adopted at the meeting and it was planned tentatively to hold another meeting of the group at Winston-Salem in January.

Westinghouse to Launch New Lighting Activity

Application of recently developed light sources to the expanding lighting needs of the nation will be studied by a new engineering department of the Westinghouse Lamp Division and will be headed by D. W. Atwater, former manager of commercial engineering.

The new organization, to be known as the illuminating engineering department, will plan for post-war as well as present-day expansion in the use of fluorescent, mercury vapor, and other light sources.

These new illuminants are already speeding production in war plants and reducing industrial accidents but to gear them to most widespread use now and after the war, engineers will need new lighting practices and methods of planning.

Mr. Atwater has been manager of commercial engineering for the Lamp Division since 1934. Born in Newark, N. J., he was graduated from Stevens Institute of Technology as a mechanical engineer in 1916. During the first World War he spent two years in France with the 12th Field Artillery. Mr. Atwater joined Westinghouse in 1920, and since then has helped to design lighting for both the Chicago and New York World's Fairs, the Holland Tunnels and other large-scale commercial and industrial illumination projects.

For many years, Mr. Atwater has been prominent in industry and engineering society activities. He is a past president of the Illuminating Engineering Society, having served for three years as general secretary and as chairman of numerous committees. He has also been active in the American Institute of Electrical Engineers and is now on the executive committee of the Better Light-Better Sight Bureau.

Electrical Leagues Hold Annual Meeting

Wartime programs of electrical leagues are vigorously attacking every wartime problem in which an electrical cooperative group has an opportunity to serve both its own and related industries and the public. That leagues are giving substantial aid to the nation's war effort was evidenced in five sessions of the International Association of Electrical League's seventh annual conference held September 17-19 at the Hotel Cleveland, Cleveland, Ohio, and attended by league managers from a score of cities including San Diego, Denver, New Orleans and Minneapolis.

Among activities discussed by the conferees were:

Inventories of appliance parts and appliances in homes, types of training programs conducted in co-operation with vocational schools, etc., wiring for wartime service, Electrical Maintenance Electricians meetings, contacts with builders, and the commercial and industrial fields, institutional advertising campaigns stressing "extra care means extra wear," city-wide plans to meet air raid and sabotage emergencies.

High praise was given the work of electrical leagues by Frank J. Ryan, assistant to the president, The Cleveland Electric Illuminating Co., who was introduced by J. E. North, president, of the Electrical League of Cleveland.

Declaring that "league managers have a top responsibility in winning the war and the peace afterward," Mr. Ryan added that, in his opinion, every town of 50,000 or more should have an electrical league.

One morning session, which was devoted to an interpretation of governmental regulations, was addressed by three representatives of the OPA.

At the business session which followed the conferences, J. A. Morrison, managing director of the Electrical Association of Philadelphia, was elected president of I.A.E.L., for the ensuing year. Other officers elected were W. A. Ritt, secretary-manager, North Central Electrical Industries (Minneapolis), vice-president; E. P. Zachman, business manager, Cincinnati Electrical Association, treasurer; and O. C. Small, who was reappointed secretary.

Number of Lamp Types Greatly Reduced by WPB

Less than half of the various types of electrc light bulbs and lamps currently produced will be manufactured after November 1 under terms of a simplification order announced by the War Production Board.

Moving to conserve materials and production capacity in the incandescent and fluorescent lamp industry, the WPB ordered that types of bulbs now made be reduced from 3500 to 1700. The cut will be accomplished through elimination of almost 2000 lamps of varying voltage, wattage, color, and other construction specifications.

There will be no curtailment in the total production of electric bulbs as a result of this action. It is expected that adequate supplies of the permitted types will be produced to compensate for those which will no longer be made.

The order, L-28-a, calls for elimination of some types of bulbs in all categories of incandescent, fluorescent and glow discharge lamps. These include household bulbs, industrial lamps, search lights, railroad signal lamps, auto headlights, beacons, and a long list of other types which cover practically every kind of electric lamp and bulb now produced.

In issuing the order, the Consumers' Durable Goods Branch of WPB pointed out that it was guided by several criteria in determining which type of lamp should be eliminated.

FLUORESCENT WAR VICTORY SHOW WINDOW—Here pictured is the fluorescent victory window which is attracting the eyes of hundreds of persons visiting G.E. Institute at Nela Park, Cleveland. Flanked on either side by flags of all the United Nations, the design of an American Eagle raises its mighty pinions of colorful fluorescent lamps to form a glowing "V." The wing feathers consist of pairs of red, white, and blue fluorescent tubes. The legend copy alludes to planes, tanks, and guns and the importance of turning 'em out faster through the saving of time. An illuminated transparency at one side of the display virtually takes the observer into a well-lighted plant where fighter planes are being assembled. Cool lighting from a fluorescent lighting system floods down upon the working levels.

Primarily, those bulbs for which suitable substitutes are available will no longer be made. Lamps for which there is no essential demand are now discontinued. Lamps which had been made in a great variety of different voltages and wattages are now simplified so that only a fraction of the previously made types will be required.

As a practical example of how the order will operate, the common household electric light bulb previously made in voltages of 110, 115, 120, 125 and 130 will now be made only in the 115, 120 and 125 volt types. These types have proven satisfactory for most household uses since the average urban home is supplied with electric power of between 115 and 120 volts. Likewise, 50 watt and 75 watt lamps will no longer be made because lamps in wattages of 15, 25, 40, 60 and 100 are satisfactory.

Colors used for lamps have been greatly simplified by the order. Only bulbs in red, blue, and green will be allowed, as compared to the large number of color variations used previously.

Blackout and Dimout Fixtures Affected by WPB Order L-168

Manufacture or sale of blackout and dimout lighting fixtures which do not conform to specifications of the War Department, Navy Department, and the Maritime Commission is prohibited by a new War Production Board order which became effective September 18, 1942.

The Order, L-168, also lays down conditions under which approved fixtures — street and highway lights, traffic signals, flashlights, lanterns, and other equipment intended for use in blackouts and dimouts — may be sold.

The principal function of blackout and dimout lighting fixtures is to control sources of artificial light in order to prevent observation from the air, or to reduce the "sky glow" in coastal areas, while permitting emergency movement to continue on the ground.

Use of such fixtures in specific "target areas" is a precautionary military measure required by the War and Navy Departments. The War Department has issued specifications governing building, street, and highway lighting during blackouts, and is preparing specifications for coastal lighting and for blackout accessories for flashlights, lanterns, traffic signals, and other related lighting equipment.

Military specifications require a certain standard of optical and mechanical performance, but do not regulate the material content of the fixture. This control is established by the limitation order.

Use of metals in the manufacture of approved fixtures is prohibited except, within the limitations of the steel and copper conservation orders (M-126 and M-9-c), for the minimum amounts of iron and steel required by the specifications, and the minimum quantities of brass and copper required to provide adequate electrical contact and conductivity.

Fleur-O-Lier Group Develop New Fixture

The war effort will be ahead more than 50,000 tons of precious fighting metals, following announcement by the Fleur-O-Lier Manufacturers of a revolutionary new fluorescent lighting fixture developed to meet the rigid requirements of war-time production lighting and yet adhere to the new specifications set by the U. S. Bureau of Standards and the WPB.

In anticipation of an order limiting the use of steel in fluorescent lighting fixtures, cooperative research by lamp makers, fixture makers and fabricators of wood fiber, asbestos, treated paper, gypsum and plastics has produced new non-metallic Certified Fleur-O-Lier reflectors. Some of the materials, when finished with a highly reflective white coating, actually have a higher reflection factor than porcelain enamel.

The result of this timely cooperation is of significant value, not only because of conservation of critical materials, but also because war industry will continue to reap the benefits of better lighting for faster production.

The Fleur-O-Lier Manufacturers is a group of over 45 fixture manufacturers participating in a program of testing and certification to a set of fifty specifications governing the design and manufacture of fluorescent lighting fixtures, in which are incorporated Certified ballasts and starters. Mazda lamp manufacturers, some four years ago, drew up the fifty specifications so as to assure the production of fixtures which would operate efficiently and dependably with the lamps for which they were designed.

Junior Physists and Technical Assistants Needed

War with its emphasis on production has overnight changed the theoretical problems of men engaged in technical and scientific work into problems of practical importance — problems demanding immediate answers. To aid them in meeting these demands, professional men are calling for hundreds of technical assistants as well as junior physicists.

In view of the scarcity of qualified persons to fill such positions, the Civil Service Commission has issued in revised form, its continuously open examinations for Technical Assistants and Junior Physicists.

For Junior Physicist ($2,000) the requirements are: completion of a four-year college course including 18 semester hours in physics. Applications will be accepted from senior students who expect to complete the required courses within six months after filing applications.

The Technical Assistant ($1,440-$1,800) examination contains three optional branches: engineering, metallurgy, and physics. For the $1,800 grade, three years of college study is required; for the $1,600 grade, two years; and for the $1,440 grade, one year. To qualify under any one of the options in any grade, certain requirements as to hours of study in specified subjects must be met.

Announcements and application forms may be obtained at any first or second class postoffice or from the Civil Service Commission, Washington, D. C.

New Officers for N. C. Contractors Association

New officers for the North Carolina Association of Electrical Contractors selected at a recent meeting were:

Hobart M. Bryant, Bryant Electric Company, High Point, N. C., president; O. W. Holmes, Holmes Electric Company, Fayetteville, N. C., first vice-president; Raymond Starr, Raymond Starr, Inc., Greensboro, N. C., second vice-president; R. H. Bouligny, R. H. Bouligny Co., Charlotte, N. C., re-elected as national councillor; R. K. Robinson, Robinson Electric Co., Charlotte, N. C., re-elected as treasurer; and F. E. Hartis, Modern Electric Company, Durham, N. C., re-elected as secretary.

The secretary's report indicated that the association had a larger number of active members than at any other period in its history.

Thermador Co. Expands Los Angeles Plant

The Thermador Electrical Manufacturing Company of Los Angeles has announced its purchase of the machinery, dies, equipment, and inventory of the Inca Manufacturing Division, at Los Angeles, of the Phelps Dodge Copper Products Corporation.

The purchase, arranged by Harry H. Fogwell, president, and William C. Cranston, vice-president of Thermador, becomes effective immediately. The purchased equipment is being installed in the Thermador Los Angeles plant, and the company will be ready to serve industry soon.

PERSONAL NOTES
About Men You Know

Chairman Donald M. Nelson of the War Production Board recently announced the appointment of **Charles E. Wilson,** president of the General Electric Company, as a vice-chairman of WPB.

In this post, Mr. Wilson will also serve as chairman of the newly-organized Production Executive Committee, and will exercise the powers of the chairman of WPB, seeing that production programs are met.

"Mr. Wilson will be the top production authority in the war program and will have the responsibility of seeing to it that programs and schedules for all phases of our war effort are met," Mr. Nelson said. "I am very glad that we have been able to enlist his services and I know that he will make a great contribution to the war program."

Charles E. Wilson

President Roosevelt, in approving the appointment, said that he was very happy to know that Mr. Wilson had been given a vice-chairmanship of WPB, and added:

"I have always considered Mr. Wilson one of the ablest production executives in the country, and he has done an outstanding job in the production of war material."

Mr. Wilson, who will serve on a dollar-a-year basis, has been president of General Electric since 1940. Born in New York City in 1886, he has been in the electrical industry since 1899, when he went to work with the Sprague Electric Co., in New York, predecessor of General Electric Co.

* * *

Clyde V. Hussey, of Arkansas Power and Light Company, was recently made assistant to President Moses, of the Arkansas company, according to announcement by Executive Vice-President Lynch. Mr. Hussey will make his headquarters in Pine Bluff.

Although Mr. Hussey is a law graduate, he has been associated with the electrical industry for more than 20 years during which period he has worked in practically every capacity from lineman up. He served as an electrician in the United States Army air service at Kelly Feild, Texas, from 1919 to 1923. In May, 1925, he joined the Florida Power and Light Company as division manager, with headquarters in Miami. In January, 1933, he was made division manager of the Tennessee Public Service Company, at Knoxville, Tenn., remaining there until 1938, when he became division manager for the Mississippi Power and Light Company.

* * *

Oscar P. Cleaver, for twelve years a lighting engineer with the Lamp Division of the Westinghouse Electric and Manufacturing Company, has been commissioned a captain in the U. S. Army Engineers Corps and has reported to the Engineer Board at Fort Belvoir, Va.

Captain Cleaver is the newly-elected general secretary of the Illuminating Engineering Society. He served formerly as chairman of the Chicago and New York sections of the society, and as regional vice-president of the New England area.

Captain Cleaver first became associated with the commercial engineering department of the Westinghouse Lamp Division in 1930. He served for five years as engineer of the Division's middle western district at Chicago. He was responsible for many of the spectacular lighting effects at the recent Chicago and New York World's Fairs.

He is an electrical engineering graduate of the Georgia School of Technology, and received a master's degree in electrical engineering at Yale University. He was an instructor there for a time before coming to Westinghouse.

* * *

G. Ross Henninger, editor of Electrical Engineering, official journal of A.I.E.E., since 1933, has been granted leave of absence to accept a commission as lieutenant-colonel in the Army Specialist Corps. He received the degree of bachelor of science in electrical engineering from the University of Southern California, Los Angeles, with the class of 1922. Upon graduation, he entered the student course of the Westinghouse Electric and Manufacturing Company, East Pittsburgh, Pa. Mr. Henninger re-entered the services of the Edison Company in 1923 as operating assistant to the electrical protection engineer, in which position he was charged with responsibility for the satisfactory operation of protective relay equipment throughout the company's system. In 1924, he left the Edison company and moved to San Francisco to become engineering editor of the then "Journal of Electricity" (which subsequently changed its name to "Electrical West"). He went to New York in 1930 as associate editor for the AIEE. He remained in the latter position until he was named editor in 1933.

* * *

Ruby Redford, for many years assistant to Carl Egeler, prominent lighting engineer at General Electric's Nela Park, Cleveland, has taken a new post with the Illuminating Engineering Society, in New York City, it was announced at Nela Park.

Miss Ruby Redford

Miss Redford, in addition to editing the Society's official publication, "Illuminating Engineering," will devote considerable time to special writing of papers released by the I.E.S., and to preparing layouts of lighting data sheets. She will serve as acting editor of "Illuminating Engineering" magazine for J. S. Russell, editor, who is now with the Navy.

* * *

W. W. Castleberry, formerly service superviser at Graybar Electric Company's Miami office, was recently appointed acting service manager at the Jacksonville office. He replaces **A. W. Palin, Jr.,** who has been granted a leave of absence to take up active duty as a captain in the U. S. Army Air Corps.

Mr. Castleberry has been with Graybar since 1932 and has served in the capacity of service superviser in various southern Graybar offices before his appointment at Jacksonville.

* * *

Square D Company, Detroit, manufacturers of electrical equipment, announce the opening of two new branch offices to better serve war material producers in strategic areas.

C. T. Nash, formerly with the company's New York office has charge of the new office at 146 Chestnut Street, Springfield, Mass., and **W. W. Hendrickson** has been transferred from the Charlotte office to open a new office in Greensboro, N. C., located at 303 Kensington Road.

SILEX HELPS YOU

"Lick" your wartime problems

with new merchandise, a new service plan and big space advertising!

Now . . . Silex goes to work for every household appliance dealer . . . with *brand new merchandise* and a revolutionary *selling plan designed for today!*

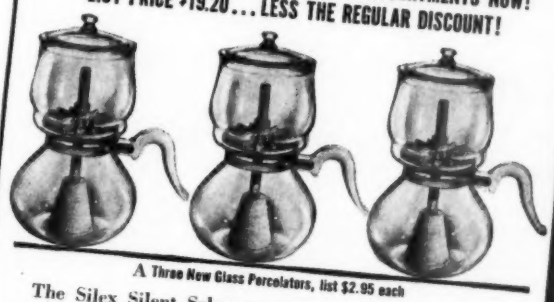
Here are three sensational new Silex *glass* coffee makers . . . one of every popular type . . . to replace the volume and profits lost when old-line housewares vanished from the market! They contain no strategic war materials . . . so you can promote and keep selling them!

And if your distributor's salesman doesn't call as often as he once did . . . *Silex will deliver the new merchandise right to your door!*

Yes, Sir . . . Silex has a new "Silent Salesman" . . . a complete package of every new item, as featured in full page, four-color advertising in The American Weekly! If you haven't seen your distributor's salesman, or our broadside, you can order your "Silex Silent Salesman" assortments direct, right now!

This is the merchandise and help you have been looking for! Take advantage of it . . . today! Stock up on these new Silex glass coffee makers, and be ready for the consumer demand Silex is creating for you!

ORDER YOUR SILEX SILENT SALESMAN ASSORTMENTS NOW!
LIST PRICE $19.20 . . . LESS THE REGULAR DISCOUNT!



A Three New Glass Percolators, list $2.95 each

The Silex Silent Salesman was designed to fill your needs for fast turnover merchandise you can promote right now . . . and to take up the slack created by fewer visits from your distributor's salesman! Assortments can be ordered and shipped direct, or through your distributor. Billing through distributors in the usual way.

B New Glass Drip Model, list $2.95 — C New Glass "Biggie," list $2.95 — D New Aiken Vacuum Model, list $4.45

The Silex Silent Salesman is a complete package! Features every new, advertised Silex glass coffee maker. Available with promotional material, including consumer folders, proofs of mats you can order for your own advertising, and attractive displays.

Pats. Pending

Prices slightly higher in Canada

FULL PAGE, FOUR-COLOR SILEX AD IN AMERICAN WEEKLY, OCTOBER 25, 1942, LAUNCHES PROGRAM! BIG FOLLOW-UP ADS NOVEMBER 8, 22; ¼ PAGE, FOUR-COLOR AD, DECEMBER 6!

Published In

Albany Times-Union
Atlanta Journal
Baltimore American
Boston Sunday Advertiser
Buffalo Courier-Express
Chicago Herald-American
Cleveland Plain Dealer
Detroit Times
Los Angeles Examiner
Miami Herald
Milwaukee Sentinel
New York Journal and American
Philadelphia Record
Pittsburgh Sun-Telegraph
Portland Oregonian
San Antonio Light
San Francisco Examiner
Seattle Post-Intelligencer
Syracuse Herald-American
Washington, D. C. Times-Herald

Read by 7,737,000 families . . . reaching customers in your own community in big-circulation Sunday newspapers!

ORDER TODAY! YOU TAKE NO RISKS!

If you are not completely satisfied with the Silex Silent Salesman assortment you buy, you may return the entire package for full credit! No Silex Silent Salesman assortments may be returned incomplete. All returns must be made postage prepaid, within ten days of shipment.

THE SILEX CO.
Dept. S.S.S., Hartford, Conn.

Send me.....S.S.S. Assortments, list price $19.20 each.

The total amount of my order is $....., to be billed through my distributor, at the regular discount. If not completely satisfied with this assortment, I may return it, postage prepaid for full credit, within 10 days of shipment from source. Only complete assortments accepted for return.

Name.....

Address.....

City.....*State*.....

Distributor's Name.....
(Distributor's name must be shown)

Distributor's Address.....

Send me advertising mats on A ☐ B ☐ C ☐ D ☐

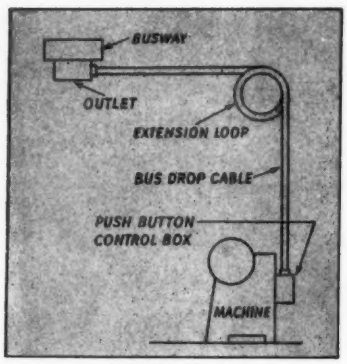
Genuine SILEX

THE SILEX CO., HARTFORD, CONN.
Creators of the Glass Coffee Maker Industry

NEW EQUIPMENT and MATERIALS

Bus Drop Cable

The General Cable Corporation, New York City, has recently issued a data sheet covering bus drop cable. This data sheet points out that actual experience in many plants shows that bus drop cable installations are flexible, dependable and time-saving because (1) conduit is not required, (2) standard fittings are used, (3) installations and connections are simply and rapidly made, (4) cost is low on completed installation, and (5) cable adjustments are made quickly and with little expense when equipment is moved.



Bus drop cable, as manufactured by General Cable Corporation, is designed for transmitting power in factories where a flexible and extensible connecting circuit is desired between an overhead open or enclosed fixed bus and the electrical motors running machinery such as lathes or punch presses. The cable is available in a variety of types and sizes. Copies of the data sheet will be mailed upon request.

Cable Splice Chart

"How to Make a Perfect Splice" is the title of a large chart now available from the Okonite Company, Passaic, N. J. The chart is suitable for posting in shops, offices, trucks, etc., for the convenience of electrical men who want to know how to make perfect cable splices.

The chart is divided into two parts, one dealing with braided cable splices, and the other with lead-covered cable joints. The entire process is described in simple instructions and pictures, in a step-by-step manner, easy to understand.

The publishers of the chart direct attention to the fact that good splices will make cable last longer, thus conserving copper, rubber and other materials. Poor splices, caused by inferior materials or carelessness in workmanship, can ruin the effectiveness of the best wire or cable. Joint failures are not only annoying but often cause the loss of vital production.

Copies of the chart are available upon request to the Okonite Company, Passaic, N. J.

New Wiremold Catalog

The Wiremold Company, Hartford, Connecticut, announces publication of a new Catalog and Wiring Guide No. 16, 1942. This new catalog, which is presented in simple and practical "service uniform," is more complete than previous editions, placing emphasis upon the many important war-time industrial applications of Wiremold products, and including new items, such as the No. 2127P polarized receptacle and the No. 2127S universal type receptacle designed to take plugs with either parallel or tandem blades, both of which were developed especially for industrial use.

The new Catalog and Wiring Guide also contains detailed instructions and information for the use of electrical contractors, plant electrical men and wiremen on the installation of Wiremold raceways and fittings and Wiremold fluorescent lighting equipment.

New Silex Catalog

The new Silex catalog, just released, introduces three brand new glass coffee makers . . . a percolator, a drip model, and a "Biggin."

These revolutionary glass coffee makers are welcome news for dealers faced with a shortage of metal coffee pots and other old-line housewares items. None of these new Silex models contains strategic war materials. They offer a new opportunity to maintain volume and profits, while affording a consumer-accepted promotional item as a traffic builder. The list price on each is $2.95.

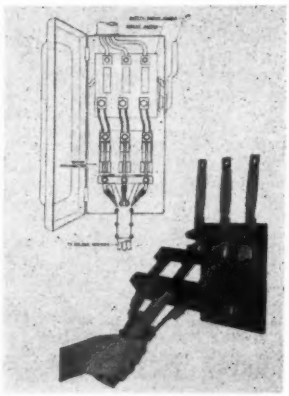
All three new models have exclusive Silex features. The percolator model combines the best features of automatic "drip" and regular "perc" methods. It has a delayed action brewing chamber, and a wide infusion area that extracts all fine coffee flavor. The new Silex "Coffee-Miser" filter insures clear, sediment-free coffee, through convenient cloth.

The new drip model features the exclusive new "Coffee-Miser" filter for a clear delicious brew and fast "drip," combining the advantages of drip with the advantages of glass. There is no metal to come in contact with the coffee.

The new Silex glass Biggin provides for a small portion of water at a time, and completely extracts every drop of fine coffee flavor. This is a perfect coffee maker for the South, although preferred by connoisseurs everywhere. For a copy of the catalog, write to The Silex Company, Hartford, Conn.

Burndy Disconnector

Many shipyards have simplified the process of handling three or four welding machines, and heavy cables running down to a source of current, by mounting them on a single frame with only one cable running down over the side of the vessel to a safety switch.



However, when the ship is moved from one working position to another, this cable has to be disconnected at the safety switch and then reconnected, and for this purpose, the Burndy Disconnector has been developed. As a result, such connections can be made quickly and safely by any unskilled helper.

The Disconnector, which can be made to accommodate either three or four conductor cable, is mounted inside the box of a safety switch (only ten inches longer than the standard box), and arranged so that the cover

TO EXECUTIVES:

NOW YOU CAN HELP

Even More...

New Treasury Ruling Permits Purchases UP TO $100,000, in any Calendar Year, of Series F and G WAR BONDS!

The Treasury's decision to increase the limitations on the F and G Bonds resulted from numerous requests by purchasers who asked the opportunity to put more money into the war program.

This is not a new Bond issue and not a new series of War Bonds. Thousands of individuals, corporations, labor unions, and other organizations have this year already purchased $50,000 of Series F and G Bonds, the old limit. Under the new regulations, however, these Bond holders will be permitted to make additional purchases of $50,000 in the remaining months of the year. The new limitation on holdings of $100,000 in any one calendar year in either Series F or G, or in both series combined, is on the cost price, not on the maturity value.

Series F and G Bonds are intended primarily for larger investors and may be registered in the names of fiduciaries, corporations, labor unions and other groups, as well as in the names of individuals.

The Series F Bond is a 12-year appreciation Bond, issued on a discount basis at 74 percent of maturity value. If held to maturity, 12 years from the date of issue, the Bond draws interest equivalent to 2.53 percent a year; computed on the purchase price, compounded semiannually.

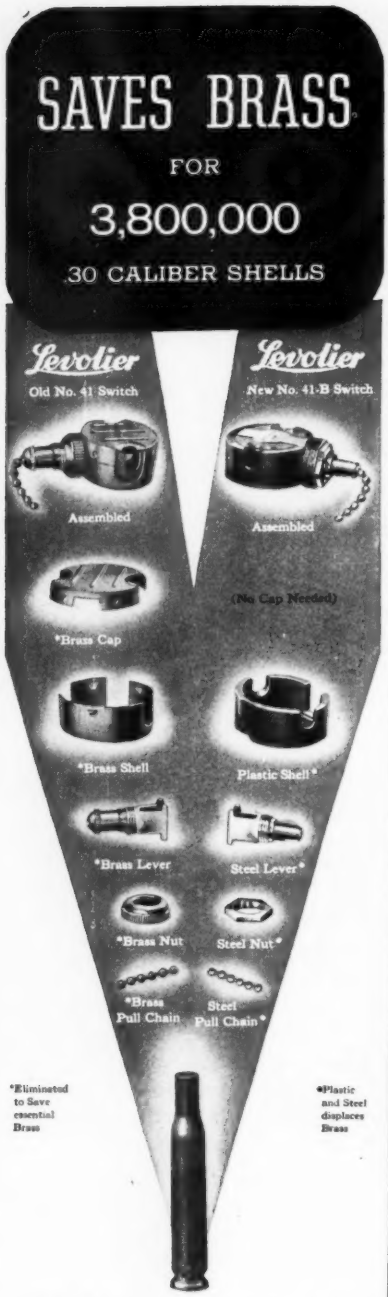
The Series G Bond is a 12-year current income Bond issued at par, and draws interest of 2.5 percent a year, paid semiannually by Treasury check.

Don't delay—your "fighting dollars" are needed *now*. Your bank or post office has full details.

Save With . . .

War Savings Bonds

This space is a contribution to America's All-Out War Program by ELECTRICAL SOUTH



In eliminating brass from McGILL Levolier No. 41-B Switch, enough critical material has been released to make 3,800,000 of .30 caliber shells. In place of the brass used a plastic casing has been developed with steel lever, nut and chain, making a sturdy unit, light in weight, easy to wire. Elimination of casing-cap facilitates assembly of switch. Ask for folder.

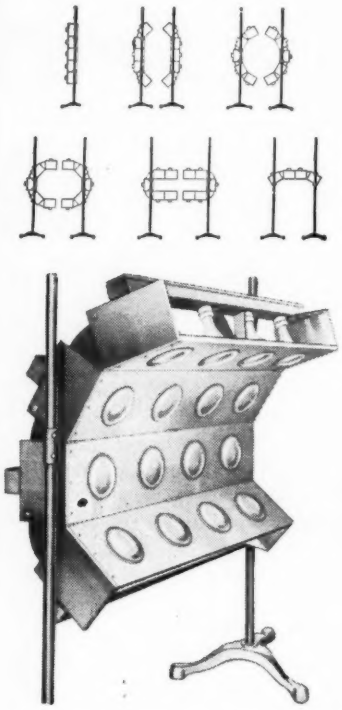
ELECTRICAL DIVISION

McGILL MANUFACTURING COMPANY, INC. VALPARAISO, INDIANA

cannot be opened unless the switch is in the open position. Connecting and disconnecting are accomplished by a simple series of steps which is not only foolproof but also very fast. Illustrated is a three-pole Burndy Disconnector, Type S3K. All cable connectors are clamp type. An additional clip and blade serves to ground the spider casting when the Disconnector is closed. The three flexible braids are attached directly to the terminal pads on the load side of the safety switch.

Flexible Drying Tunnel

The Wil-Son Mfg. Corp., Chicago, has just introduced a new infra-red drying tunnel. This new tunnel uses the General Electric combination reflector and lamp. The overall operating efficiency of this new tunnel is increased to the maximum, through the use of lamp shields, plus complete flexibility of adjustment of each lamp row, making it possible to change the entire tunnel shape within three minutes time.



The manufacturer points out that the maximum efficiency is obtained with these tunnels at all times through the use of this flexible construction. This tunnel can operate with maximum efficiency on two or three completely dissimilar jobs in the same day, requiring practically no change over time—which makes it ideal for job shop work as well as for production work.

Motor Application Data

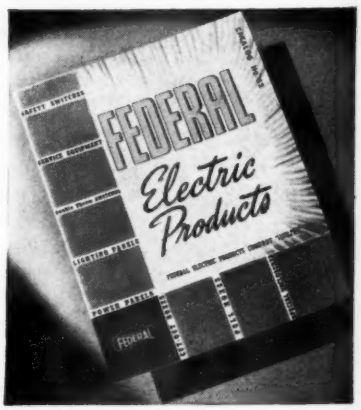
The Allis-Chalmers Mfg. Company, Milwaukee, Wisconsin, has just released a new motor bulletin, designed to give all the facts necessary for quickly choosing correct motors for wartime applications, thereby fully utilizing electric motor power and conserving vital war materials.

In the new book, Bulletin B6052-C, compact, simplified charts permit the reader to determine at a glance all electrical and mechanical characteristics of the motor types designed for the specific application in which he is interested. For each design and application relationship, rating, duty, torques, starting current, efficiency and slip are indicated — for squirrel-cage, wound rotor, direct current and synchronous motors.

In addition, construction features of various Allis-Chalmers Lo-Maintenance motors are completely described and numerous typical applications are illustrated.

Federal Electric Products

The newest catalog of the Federal Electric Products Company, Newark, N. J., has just come off the press. A comprehensive 68-page, 2-color catalog, it contains a wealth of useful engineering information on safety switches, panelboards, circuit breakers, etc. It includes photographs and complete specifications of each type plus photographs showing some typical Federal installations.



It includes complete data on allowable increased horsepower ratings, wiring data for motors, number of conductors in conduit, a simplified numerical cross-index and many tables to help the reader in the selection of the proper switch for different sizes and types of motors.

Uptegraff Transformers

R. E. Uptegraff Manufacturing Company, Scottdale, Pa., has issued a new bulletin on Uptegraff distribution transformers. Eight types of distribution transformers are illustrated with a brief description of each. A copy of this new distribution transformer bulletin No. 115, may be had by addressing R. E. Uptegraff Manufacturing Company, Scottdale, Pa.

Nofuze "De-Ion" Breaker

A new Quicklag breaker introducing three basic advances in circuit protection is announced by the Westinghouse Electric and Manufacturing Company.

Quicklag offers fast opening action on short circuits, full time delay on overloads, and new low cost. This new breaker successfully combines in a single unit a cooperative thermal-magnetic trip action. It is available in ratings of 15, 20, 25 and 35 amperes, single-pole only, 125 volts a-c.

Quicklag is designed to give practical circuit protection for all kinds of lighting, appliance and fractional motors. This six-ounce breaker can stop a force equivalent to 230 horsepower, and gives adequate protection for portable tools and appliances using small wire sizes.

Porcelain Outlet Boxes

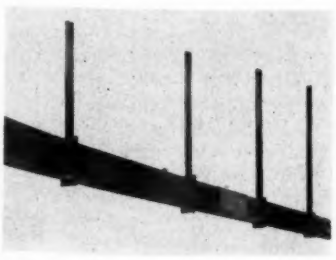
Three new porcelain outlet boxes are described in a leaflet recently issued by Pass & Seymour, Inc., of Syracuse, N. Y. The new boxes include a flush switch box, No. 8310, which is a standard size with standard screw spacing and tapping. The 3¼" outlet box, 1½" by 1-29/32" high with standard screw spacing and tapping, is listed as well as a 4" outlet box, also 1½" x 1-29/32" in depth and height.

The leaflet also describes the new P & S porcelain Cablettes. Cablettes are designed for use with non-metallic sheathed cable and permit installation directly on the surface without the use of boxes, clamps, connectors or soldering. They are easy to wire, being made of two-piece design consisting of base and lampholder body. A removable knock-out is built into each device to close the opening when feed-thru run is not required. The device is available both as a keyless receptacle and as a pull receptacle.

Saflex Feeder Duct

Announcement has been made by the engineering department of the Switch & Panel Division, Square D Company, Detroit, of a new low-reactance feeder duct which has several distinct advantages. The duct is designed primarily to serve as the feeder between transformer banks and main switchboards or as feeders to branch circuits where minimum voltage loss is essential.

It is ideally suited also for welder circuits as it provides a compact con-



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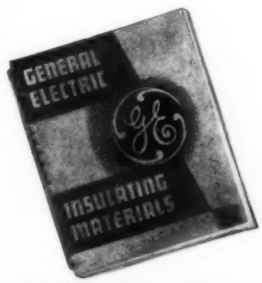
Increased war production and reduced maintenance go hand-in-hand. War plants cannot afford "time-outs" for repair and replacement of production equipment. That's why we recommend G-E Insulating Materials to keep maintenance at a minimum.

G-E Insulating Materials have the ability to "take it." Let them do this tough job for you.



FREE

You can get this complete catalog of G-E Insulating Materials containing pictures, descriptions, specifications, etc. Just see your nearest G-E Merchandise Distributor or write to Section M1024-16, Appliance and Merchandise Department, General Electric Company, Bridgeport, Connecticut.

GENERAL ELECTRIC

ductor of low voltage drop (only 1.8 volts per 100 feet) and therefore conductor size may be kept at a minimum. As the duct is principally enclosed in special non-critical non-metallic insulation, the absence of enclosing steel eliminates iron losses and hum, as well as the pulsations sometimes experienced from the impact of heavy welder loads in other types of feeders.

Saflex Feeder Duct provides balanced phases at all points because of a special split-bus arrangement which provides electrical symmetry of the phases. The uniform low voltage drop is due to close spacing of the busses, separated by only ¼" of insulation. In full-load tests this duct has only a 38° C temperature rise.

This duct is available in capacities from 500 to 6000 amperes, 600 volts or less for single phase, 2 and 3 phase and 3 phase, 4 wire services.

Insulation Tester

The Model 520 Insulation and Breakdown Tester, manufactured by Superior Instruments Co., New York City, features a super-sensitive danger indicator which lights up to indicate leakage up to 1,000 megohms, (1,000,000,000 ohms). Four voltage sources are available, 250, 500, 1,000 and 2,500 volts. No hand-cranking and no adjustments are necessary.

To use, simply connect the two test leads to the circuit, appliance or motor to be tested, then throw the switch. The danger indicator will instantly light up to indicate defective insulation, or insulation which, because of its excessive leakage, indicates a potential or imminent breakdown. The Model 520 will also indicate "shorts" and "opens" and as a safety feature includes a jewelled pilot lamp on the front panel which indicates when high voltage is on.

The instrument is housed in a portable carrying base with compartment for test leads and a specially designed cover attached in a jiffy assures complete portability. Operates on any 90 to 125 volt, 60-cycle a-c source. Size 6" x 8" x 4¾". The tester sells for $14.85.

Sylvania Fixture Catalog

A new fluorescent lighting fixture catalog is being offered by Sylvania Electric Products, Inc., (formerly Hygrade Sylvania Corporation). This catalog is designed to simplify the prospect's problems of selecting the proper types and quantities of fixtures for his particular lighting project. Besides illustrating over thirty models, complete with technical specifications, this book contains a list of recommended minimum standards of illumination, information on how to plan a fluorescent installation.

Service Sales Letters Effective

(*Continued from page 30*)

fix it, a service charge of $1.50 is made for an inspection and test. However, this is refunded if the job of repairing the machine is obtained. It is seldom that anyone objects to the inspection charge, Holt said. It is explained in advance, which obviates a misunderstanding later.

When asked what is the "secret" of their success in building up such an excellent service business, Holt pointed to the parts room and said, "There is one of the reasons; we've got the parts," and he exhibited a huge stock of replacement parts, belts, motors, etc., for refrigerators, washers and other appliances, the total inventory running around $8,000, he said.

"We service all makes of refrigerators, washers, ranges and radios — and I mean *we service them*," Holt said. "This is how we can do it: factory-trained men, large stocks of repair parts, and twenty-four-hour service." The mechanics who service refrigerators and washers are sent to factory service schools and this fact is stressed in advertising.

In the shop are two men working on refrigerators and two who work on washers. The shop is operated on a 24-hour basis in this manner: the store is kept open till nine o'clock, and after that hour the telephone is switched to the home of a service man, who will take a call at any hour of the night and make the trip if there is an emergency.

Whenever shop work slows down, more letters are put in the mail and the men on the sales floor get busy with the telephone. Very soon the shop is crowded with work and the solicitation tapers off till there is another lull in the shop.

And there's just as much difference between the *streamlined* BRIEGEL METHOD of making conduit connections and former, old-fashioned methods!

Take a look at the picture below: two squeezes with the patented B-M "indenter" (which costs only $1.25) and you have a smooth, efficient job when you use B-M connectors and couplings. No extra turns or twists—no nuts to tighten!

The BRIEGEL METHOD saves you up to 50% on time and a substantial materials-saving (in keeping with today's thinking). Means more profit, too! Approved by Underwriters' Laboratory, of course.

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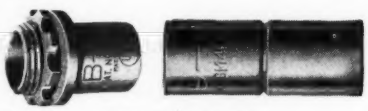

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Clayton Mark & Co.
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National Enameling & Mfg. Co.
Pittsburgh, Pa.
Triangle Conduit & Cable Co.
Elmhurst, N. Y. C.

BRIEGEL METHOD TOOL CO., Galva, Ill.

Inventory Your Man Power Now

(*Continued from page 25*)

his plant and who then fails to request deferment for his key men is also negligent.

A good rule to follow: Don't ask deferments for any men who can be replaced by training another individual not likely to be eligible soon for service.

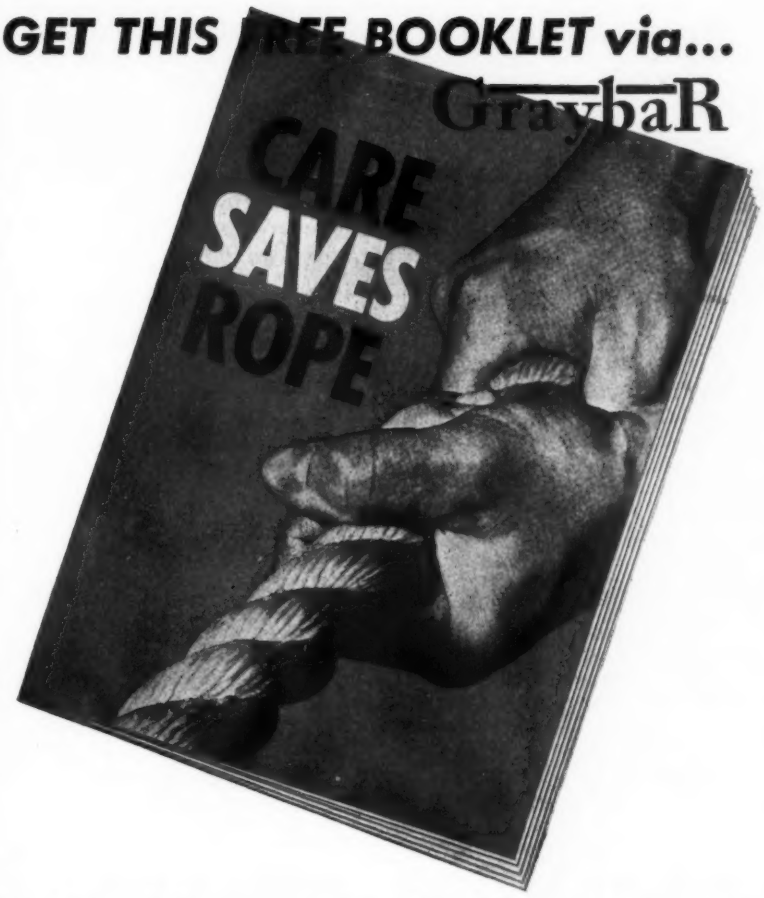
Make an inventory, request deferment for any man whose immediate going into the armed services would retard production of vital war material or other services essential to the war effort, or who is needed to maintain national health, safety and interest.

Only when an employee is working in a critical occupation within an essential industry should a Form 42A be filed for his temporary occupational deferment.

Yes, an inventory within a man's own plant is called for; also an appraisal and analysis of the manpower in the community. There is many a man over 45, or a man physically handicapped, or a woman who can do that job that the 23-year-old boy is doing who took a 12-weeks course at a learn-quick school.

There are not more than sixty million people in this country who are capable of effective productive effort. These men and women represent our total manpower available to win the war. They must do everything that must be done in a total war; maintain transportation, communications and utility systems, maintain public services, grow food for ourselves and our allies, mine the metals and produce the raw materials, fabricate and produce the amount of consumers goods necessary to maintain even a restricted national life and the supplies, weapons and munitions of war; also most of all they must provide the men who land on strange shores in far places, the men who carry the fight to the enemy on a multitude of far-flung frontiers. The rest of the population who mine raw materials and produce the weapons with which these men fight must be a self-disciplined team working in unity. The individual personal convenience, comfort or pleasure, or the convenience and ordinary leisurely replacement programs of the employer, will have to be given progressively less consideration as the war gets tougher and the casualty lists grow.

GET THIS FREE BOOKLET via... GraybaR



Rope is a vital war material — here's how to conserve it

The rope you get "via GRAYBAR" is made for hard work . . . but its strength and service life depend greatly on the care it receives. You can help yourself and help the nation by seeing to it that your linemen and other users of rope are fully informed on the best methods of caring for rope.

All the important points on rope care are covered in an easy-reading practical way in the booklet "Care Saves Rope". In addition, it shows how to make splices and tie knots, and gives data for matching ropes to blocks, and for making load calculations. It has been prepared by the American Manufacturing Company, makers of "American Superior" and "Amco All-weather" pure Manila ropes, and "War Eagle" pure sisal rope . . . the brands you get from GRAYBAR.

For a copy of this illustrated booklet, just mail the coupon to GRAYBAR. And keep in mind that your local GRAYBAR representative is prepared to help you obtain rope or other outside construction supplies whenever they are essential to the war effort.

GraybaR ELECTRIC COMPANY

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Please send your free booklet "Care Saves Rope".

Name..... *Title*.....

Company.....

Address.....

City..... *State*.....

Plastics Are Now War Materials

(Continued from page 19)

of a neat, compact assembly of a commutator brush ring.

Portable Electric Machines. Of the machines which accord the most favorable reception to plastic materials, the small portable, hand-supported electrical machines are among the best known. The number of molded housings for this application alone runs well into the millions. Among the classes of portable machines which benefit by the application of plastics are electric dry shavers, hair clipping machines, electrical grinding and drilling tools, electrical rotary tooth brushes, erasing machines, etc. When parts of rotating electric machines are to be in contact with any part of the body, it is imperative that a high-insulation resistance be maintained throughout the structure. Nothing seems so satisfactory as a complete shell or sleeve for the motor unit, as a molded plastic material, or laminated tubing.

Radio Housings. Molded plastic housings for radio equipment have been widely acclaimed as beautiful examples of artistic effects in molded plastics. These applications have done much to popularize molded plastics with the general public. Inasmuch as relatively large quantities of plastics are involved in the molding of radio housings, material cost is a large item, and for this reason the thermosetting phenol and urea plastics have received the bulk of this trade.

Further examples of plastics applied for their mechanical and decorative effects lie in typical business machines, typewriters, instrument cases, vacuum sweepers, etc.

Thermal Applications

Though organic plastics are comparatively poor in their resistance of high temperatures, the thermosetting compounds are widely employed in temperatures up to 300 degrees Fahrenheit, and higher for resistant grades.

Modern design trends in household cooking utensils and small heating appliances are resorting to plastic materials because of their low thermal conductivities. Non-softening thermosetting plastics of lower thermal conductivity generally are employed as handles for hot vessels. For the attachment of electrical heating coils, cold-molded plastics often are used in the construction of plugs and receptacles. Their lower cost, in addition to their ability to withstand slightly higher temperatures and still maintain their strength, are good reasons for their utility.

The applications of such a material seem to be many and varied, particularly in the more complicated industrial field and more particularly in the electrical appliance field.

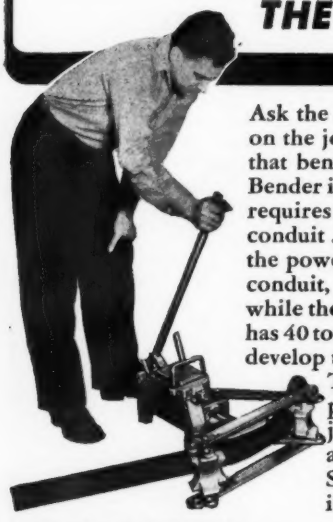
It is conceivable that the electric refrigerator of the future may be formed from a plastic material which is in itself a structural unit, a thermal insulator and an electrical insulator. This is indeed a happy combination of properties to be embodied in one material. The increased cost of materials will no doubt be offset by the saving of labor in assembling and finishing.

Vacuum-cleaner manufacturers had previously become plastic-conscious but with improved characteristics of present plastics and the search to develop new properties and new materials of far reaching economic utility, this trend will be enhanced in the future.

The development of today, employing new materials and methods to produce war materials, will be used tomorrow for producing those "Electrical Servants of the Household," upon which we have all come to rely. Not only will their faces be lifted, with plastics, but their bodies will be strengthened as well. But today, plastics are war materials! They should no longer be considered as "substitutes."

GREENLEE BENDERS

EASIER AND FASTER FOR THE MAN ON THE JOB



Ask the man who knows . . . the operator right out on the job doing the bending . . . and he'll tell you that bending conduit with the Greenlee Hydraulic Bender is even easier than it looks. To bend conduit requires power . . . approximately 31 tons for 4-inch conduit . . . and Greenlee Hydraulic Benders have the power. The No. 770 Bender, for 1¼ to 3-inch conduit, has 25 tons of easily developed power, while the No. 775 Bender, for 3 to 4½-inch conduit, has 40 tons of hydraulic power. One man can quickly develop this power by simply pumping the handles. These light, portable benders are built compactly into one unit, are easily carried to the jobs and set up, and will not move and twist about when in use. Our Bender Booklet S-116 will show you how you can cut bending costs on every job.

Greenlee No. 770 Bender

Send for BENDER BULLETIN S-116

GREENLEE TOOL CO.

1770 COLUMBIA AVE., ROCKFORD, ILL.

Laying Out Industrial Motor Circuits

(Continued from page 17)

temperature) 5 minutes after it had been operated with a full 50 hp loading, starting from "cold operation." This type of motor operated on a duty cycle would tend to cool down quickly and thus permit the entire wiring system to operate at a general over-

all lower average temperature. From a tmperature consideration only, the feeder size may be reduced for each such individual motor as shown by the table. The same motor rated at 60 minutes would require a longer time to reach its maximum temperature and conversely would take more time to cool off. A larger size feeder must therefore be provided to keep it from overheating and deteriorating its insulation.

This table, as stated above, classifies elevator motors as intermittent duty units. A 5 or 15 minute rated motor may have feeders sized to 85% of the motor rated current. Thus a 100 ampere, three-phase, 220 volt elevator motor (approximately 40 hp) may be connected to its source of supply with three No. 4 Type RH conductors (capacity 86 amperes) installed in 1¼-inch conduit. If the motor is rated for 30 or 60 minutes, the feeder must have a capacity of 90% of the motor full load current; and for continuous rating, 140%. For long elevator feeder runs it will be necessary to increase the feeder size to insure adequate voltage to the motor. As a rule, the elevator manufacturer will recommend the feeder size required. If this information is not available then the individual feeders to each elevator motor, for all average installations, may be sized on the basis of 125% of full load current.

Where a larger number of motors are to be installed, the diversity of use of these units may be such as to keep the simultaneous maximum demand of the entire load below the total connected. For example, tests on motor generator type welders show that the maximum demand established by such a load is about 30% to 40% of the total connected. Assume a feeder for 100 SAE, 300 ampere welder units each having a 20 hp, 220 volt, three-phase driving unit, requiring 52 amperes for full load running. Theoretically, a total of 5200 amperes would be required for the 100 machines. However, good feeder design may be obtained if a maximum current of 2000 amperes (approximately 40% of 5200 amperes) is used. The Code provides for the use of a demand factor if the authority enforcing the Code grants permission for its use. Very often the feeder may be reduced, without sacrificing efficiency of operation,

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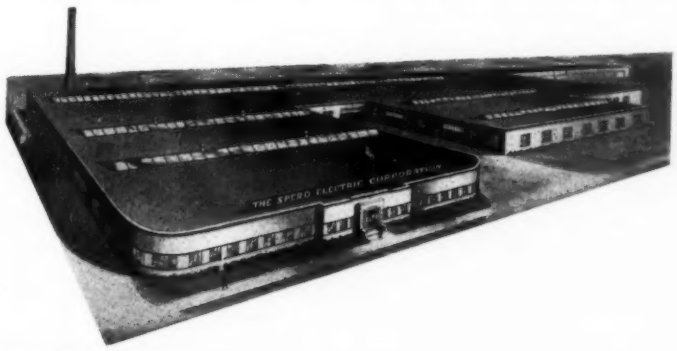
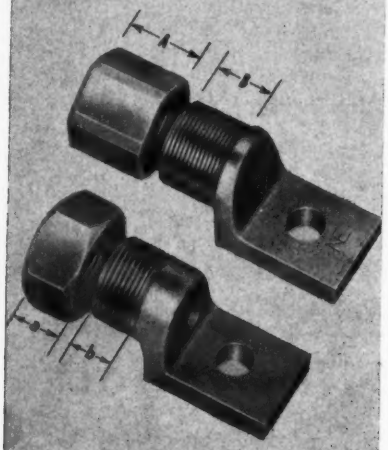
A big modern factory, 30 years' experience and 5 lines of products tuned to today's demands, from one dependable source save time, speed installation, avoid costly delays. Write today for complete information.



THE SPERO ELECTRIC CORPORATION
18222 LANKEN AVENUE ★ CLEVELAND, OHIO

Did You Know

when two bodies are drawn together with fine, long threads, a tighter and stronger fitting is possible? There is less possibility of backing away due to vibration or external action. Gorilla Grip Mechanical Electrical Connectors have extra long, fine threads.



A quick comparison of the nut and thread of any other connector with a Gorilla Grip will illustrate our point.

The lug with the stamped "NE" on the body is a Gorilla Grip. Note the length of the thread (B) and also the fineness, then measure the length of the nut (A). A quick glance will convince you of the Gorilla Grip's superiority.

With a reasonable amount of care, the possibility of failure is entirely eliminated. The only essentials for making a perfect connection are that the proper connector for a given size of wire be chosen and the parts securely tightened. National Electric Gorilla Grip Connectors positively will not loosen after the connection is made.

There is a Gorilla Grip Connector for every connection wherever it taps or terminates.

Write for a booklet giving more detailed facts.

National Electric
PRODUCTS CORPORATION
300 FULTON BUILDING, PITTSBURGH, PA.

to a much smaller size than required by the basic rule, if a complete study is made of the customers load and operation.

If a combination load is to be served, that is, motors, lights, appliances, etc., the feeder size is still based on 125% of the full load current of the largest motor plus the running currents of all the other motors plus a sufficient capacity for the other load. Demand factors may be applied but must always be approved by the enforcing inspection authority unless specifically called for in the Code.

In addition to the exception discussed above for duty cycle operated motors, the Code permits individual small stationary motors to be operated on feeders smaller than specified in Table 20. The Code permitted 1/3 hp or smaller motors to have the circuits between the stationary motor and its connection junction box to be smaller than No. 14 specified in the table.

Feeders for Small Motors

For these smaller size motors it may be simpler construction to bring the motor loads out from the frame to this junction box than to try and set a terminal box on the motor frame and bring the ends of the motor windings into it. Figure 27 shows this diagrammatically and indicates that this extension may be made with No. 18 or No. 16 wire, provided: (a) the wire size has sufficient capacity, i.e., 125% of full load current, (b) the total extension from the motor to the frame is six feet or less, (c) the conductors are enclosed in some type of metal raceway 3/8-inch trade size or larger, and (d) the metal raceway is connected to the motor and the box.

The current carrying capacity of No. 18 wire is 5 amperes (other than heater cord types) and the capacity of No. 16 is 7 amperes. A d-c 1 hp, 220 volt motor has a full load current of 4.3 amperes. A feeder having 125% capacity must be capable of carrying 5¼ amperes. This is well within the capacity of the No. 16 wire. Similarly, it will be found that a 1 hp single phase, 220 volt motor and all polyphase motors rated at 220 volts or higher in sizes 1 hp or less could be fed from No. 16 or No. 18 feeders. The Code is being revised to recognize this and the rules stated above will apply to 1 hp motors or smaller.

A wound rotor induction motor (see Figure 28) usually has two or three sets of external feeders. One set connects directly from the source of supply to the motor stator windings. These depend upon the motor rating and are designed as for any other motor. For exxample, a 25 hp, three-phase, 220 volt wound rotor, according to Table 24, has a full load current of 64 amperes, therefore the minimum feeder capacity must be 1.25 x 64 = 80 amperes.

A second set of feeders connects the rotor through a set of slip rings to a controller and resistor bank. The motor name plate, as a rule, shows the full load rotor current. The feeder should have a current carrying capacity equal to 125% of this current for continuous operation of the motor. For duty cycle operation the Table on top of page 154 of the Code, previously referred to, may be used.

In most installations the controller, which is similar to the drum type used on trolley cars, is one unit and the resistor bank a second unit. Both of these are

Keeping pace with UNCLE SAM

You can't go *"all-out"* when you're *"all-in"*...the air-conditioned, noise-proofed rooms and inner-spring mattresses at Hotel Mayfair renew your energy.

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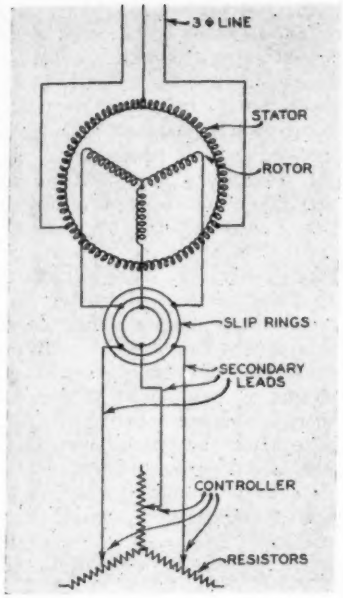

Fig. 28. In wiring for installation of wound-rotor a-c motors consideration also must be given to the secondary circuit, controller and resistors.

mounted in separate cases and must be interconnected by the electrician. The feeders between the controller and the resistors are sized for a capacity range equal to 35% to 110% of secondary full load current depending upon the actual function of the resistors.

If the resistors are only in circuit to start the motor and then are cut out entirely after the motor is up to speed, the feeders may have considerably less current carrying capacity than the full load secondary current draft. Thus for light starting duty, usually an unloaded motor, the feeder capacity need be but 35% of the full load secondary current. For heavy duty this minimum capacity is increased to 45%, and for extra heavy duty to 55%, of full load secondary current.

Where speed control is also a function of the resistors then a large percentage of capacity is required for the feeders since part of the resistors will always be in circuit. The percentages for a duty cycle wherein the resistors are left in for a short period of time are given as follows:

Light intermittent duty	**65%**
Medium intermittent duty	**75%**
Heavy intermittent duty	**85%**

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THE NEW FEDERAL CATALOG

— *just off the press!*

. . . and it's yours for the asking.

This new 68 page, illustrated 2-color catalog is designed to provide a quick, ready reference to help you in the selection of the proper switch or panelboard or circuit breaker for every use.

You will find it a valuable source book. For it contains a complete listing of specifications and list prices of the Federal line *plus* a wealth of useful additional information—Allowable Increased Horsepower Rating, Number of Conductors in Conduit, Wiring Data for Motors. And you will find in it a simplified numerical cross-index to make comparisons easy.

Write for your copy now! You're sure to find it a handy, time-saving aid.

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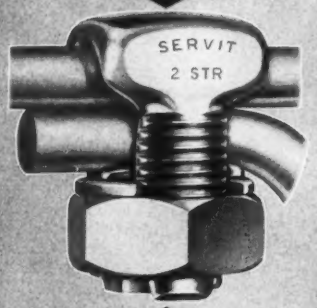

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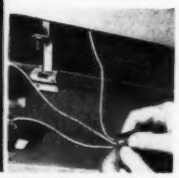

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Prompt Shipment

Speed wiring of War Plants and homes by using "Wire-Nuts". They do not use critical materials—Lead, Tin and Rubber—as required for solder-and-tape joints—hence they are available to you *right now.*

Better Electrically; Stronger Mechanically. MILLIONS IN USE. Fully approved. Listed by Underwriters' Laboratories, Inc. SIZES FOR EVERY JOB.

Write for FREE Samples, Now.

OTHER IDEAL WAR-TIME WIRING SPEEDERS

IDEAL SOLD THROUGH JOBBERS
IDEAL COMMUTATOR DRESSER COMPANY
1017 Park Avenue Sycamore, Illinois

If the resistors will remain in circuit continuously then the minimum feeder capacity should be 110% of the secondary full load current. As a rule the manufacturer will recommend the correct size for the feeders between the controller and the resistor bank.

Again, let it be emphasized that all these design factors are minimum values. For correct and efficient operation of the motor, consideration must be given to voltage drop. Use the Code values with a full realization that they are the minimum values recommended.

Organized Maintenance For Industrial Plants

(Continued from page 10)

ent motors. Some motors will require oiling daily. Most motors will require oiling only at intervals recommended by the manufacturer but even these must be changed in some cases to take care of extraordinary conditions. For example, in dusty or damp locations, it may be necessary to drain the oil once a month and renew it. In preparing such a maintenance schedule, consideration must be given not only to the type of equipment but also to the severity of the service. For example, it will generally be satisfactory to inspect brushes and commutators of motors and generators once a week, but when the service is particularly severe, it may be necessary to make these inspections daily. Motor control equipment may require contact inspection only once a month, but heavily used equipment may need inspection as often as once a week.

In any event, the more carefully the master maintenance schedule is prepared, the more likely will it eliminate shutdowns due to equipment failure.

Important factors in any such maintenance schedule are the inspection reports turned in by the maintenance crew. These inspection reports show the condition in which equipment is found and indicate the work that must be done. In most instances, when a defective part is found, and it needs immediate attention, the repair will be made at once. It will generally be found that most minor repairs can be made at some predetermined shutdown period, such as lunch time, change of shift, change of setup, etc. The nature of the defect, when it requires a shutdown of considerable time, would have to determine whether temporary repairs can be made until the machine can be taken out of service without interferring with production.

From time to time, machine tools are taken out of the production line for rebuilding or a general overhauling. When this is done, the maintenance department should give particular attention to electrical equipment such as motors and control associated with such machine tools so that the electrical equipment will not be likely to cause trouble at a later date after the machine goes back into production.

In most plants, it may be possible to make the operator of each machine responsible for certain daily or weekly operations such as oiling, checking bearings for high temperature or excessive endplay, etc. In larger plants, it may be possible to assign electricians or trouble shooters to inspect, repair, clean, and oil all motors and controls for machine tools.

In some plants, these men, who

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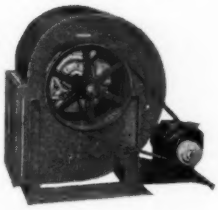

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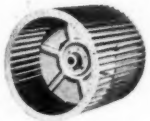

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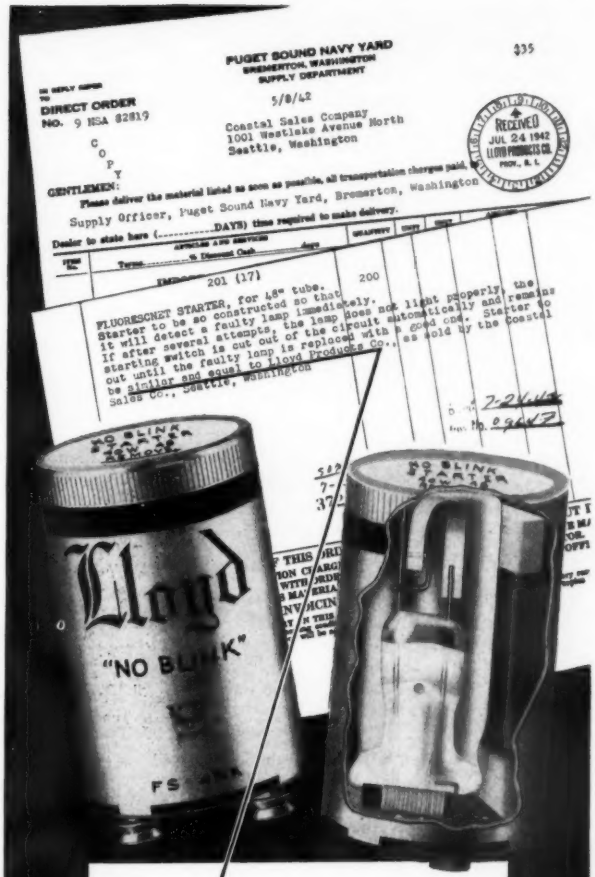
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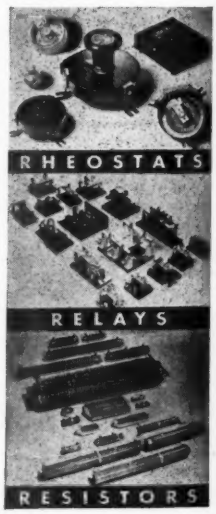

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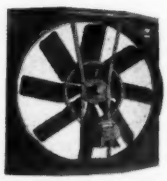

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115. FLUORESCENT LIGHTING ACCESSORIES—Fall Bulletin No. 3, describing and illustrating complete Lloyd line of Fluorescent Lamp Holders, Starters, Starter Sockets and Holder and Socket combinations. Lloyd Products Company, Providence, R. I.

117. MECHANICAL CONNECTORS—First Aid for electrical systems through the use of mechanical connectors is the subject of an interesting twenty-page booklet now available. In addition to specific construction and sales of the new "Gorilla Grip," this booklet describes a wide range of mechanical connectors for every size and purpose. National Electric Products Corp., Pittsburgh, Pa.

120. SQUARE D COMPANY announces the Spring issue of the Square D Digest, dated April, 1941. This condensed catalog contains listings and the latest prices of many Square D products, including Safety Switches, Service Equipment, Multi-breakers and other Circuit Breakers, Panelboards, Motor Control and Pressure Switches. Square D Company, Detroit, Michigan.

129. BULLETIN 403 on BullDog enclosed bus bar system of electrical distribution for commercial and industrial use. Forty-four pages of construction details, applications, dimensional data and technical charts. BullDog Electric Products Company, 7610 Jos. Campau Avenue, Detroit, Michigan.

132. INDUSTRIAL WIRING HANDBOOK: This 48-page handbook, called "Adequate Wiring for Industry," describes modern factory wiring methods and materials. Wiring practices adaptable to all factories are outlined. Publ. No. 51-4011. General Electric Co., Appliance and Merchandise Dept., Bridgeport, Conn.

142. ELECTRICAL CONDUIT — Complete technical information on corrosion-resisting asbestos-cement ducts for underground and overhead service, with and without concrete envelop, is included in "Transite Conduit and Korduct for the Electrical Industry," DS Series 410. Johns-Manville, 22 East 40th Street, New York, N. Y.

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155. ELECTRICAL CONNECTORS — 325-page catalog describing and illustrating Burndy clamp connectors for overhead distribution and transmission, substations, grounding, underground distribution and industrial wiring. Contains 84 pages of useful technical information. Company asks that requests for the catalog, Catalog No. 40, be written on company letterhead. Burndy Engineering Co., Inc., 107 Eastern Boulevard, New York City.

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165. TECHNICAL DATA ON J-M TRANSITE ASBESTOS-CEMENT ELECTRICAL DUCTS—Including installation and special fitting data on J-M Transite Electrical Conduit and Korduct—a bound set of technical data sheets on the two asbestos-cement duct materials. Primarily prepard for designing engineer and installation supervisor, the 42-page book is chuck-full of practical information for anyone concerned with underground or overhead duct installations. Tables giving dimensions of ducts and fittings and numerous installation photographs are included. Copies of the book, Form DS Series 410, may be obtained upon request to Johns-Manville, 22 East 40th Street, New York City.

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167. NATIONAL ELECTRIC ENGINEERING DATA BOOK—A 350-page engineering data book and catalog of National Electric Products is now available. In addition to the section containing tables and wiring data, this publication includes complete catalog specifications and prices on conduit, industrial busways, surface raceways, "Plug-In" strips, armored cable, flexible tubing, "Gorilla Grips," brackets and wireholders, fuses, and wire and cable. A special feature of the publication is a listing of the Federal specifications with which the National Electric Products comply. National Electric Products Corporation, Pittsburgh, Pa.

168. GREENLEE TOOL CATALOG NO. 33-E — a 48-page catalog of GREENLEE TOOLS for bending conduit and tubing, pushing pipe underground, pulling in cable, punching holes in steel cabinets and panels, boring holes in wood and doing various other operations. Greenlee Tool Co., 1766 Columbia Ave., Rockford, Ill.

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ADVERTISER'S INDEX

A
Adam Electric Co., Frank 3
Aluminum Co. of America 2
American Coolair Corp. 58
American Steel & Wire Co. ..... *
Anaconda Wire & Cable Co. ..... 4 and 5
Automatic Electric Mfg. Co. ..... *

B
Briegel Method Tool Co. 50
Bull Dog Electric Products Co. 35
Burndy Engineering Co., Inc. 56

C
Columbia Steel Co. ..... *
Crescent Insulated Wire & Cable Co., Inc. ..... *
Curtis Lighting, Inc. ..... *

D
Dolph Co., John C. 60

E
Edison General Electric Appliance Co. 39

F
Federal Electric Products Co., Inc. 55
Frigidaire Division 6

G
General Cable Corp. ..... *
General Electric Co. (Insulating Materials) 49
General Electric Co. (Lamps) 8
General Electric Co. (Wiring Materials) ..... Back Cover
Graybar Electric Co. 51
Greenlee Tool Company 52

H
Hazard Insulated Wire Works 1
Hotel Lennox 56
Hotel Mayfair 54
Hubbard & Company ..... *
Hunter Fan & Ventilating Co., Inc. ..... Front Cover

I
Ideal Commutator Dresser Co. 56
Insulation & Wires, Inc. 58

J
Johns - Manville ..... *

L
Lloyd Products Co. 57

M
McGill Mfg. Co. 48

N
National Electric Products Corp. 54

O
Okonite Company 1

R
Revere Electric Mfg. Co. ..... *
Rogers, C. B. 58

S
Sangamo Electric Co. ..... *
Schwitzer-Cummins Co. 57
Silex Company 45
Spero Electric Co. 53
Square D Company ..... *
Sticht Co., Inc., Herman H. ..... *
Sylvania Electric Products, Inc. ..... Inside Front Cover

T
Treasury Department 47

U
Uptegraff Mfg. Co., R. E. ..... Inside Back Cover
U. S. Steel Corp. ..... *
U. S. O. Committee ..... *

W
Walker Electrical Co. 57
Ward Leonard Electric Co. 58
Westinghouse Electric & Mfg. Co. (Industry) ..... 32 and 33
Westinghouse Electric & Mfg. Co. (Lamp Division) ..... *
Westinghouse Electric & Mfg. Co. (Motor Controls) ..... *
Wiegand Co., Edwin L. ..... *

Y
Youngstown Sheet & Tube Co. ..... *

--- 3
--- 2
---58
---
and 5

---50
---35
---56

---60
---39
---55
---- 6

----49
---- 8
Cover
----51
----52
---- 1
----56
----54
---
t Cover
----56
----58

----57
----48
----54
----- 1

----56

-----57
-----45
-----53

-----
nt Cover
-----47
ck Cover

-----57
-----58
2 and 33
a)----
s)----